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CLEVELAND, O., FEBRUARY 13, 1890.

THE WEEK IN IRON CIRCLES.

General Features. There is not much change in the condition of the market during the past week. The makers are firm in their views, while the consumers are well stocked, and can afford to wait. The reports from leading trade centers indicate light sales, but hopeful prospects, as will be seen below: While the iron market continues dull and lethargic at Cincinnati, there are more strong than weak features apparent. It is asserted positively by those in best position to judge, that current consumption is keeping full pace with production. This seems to be proved by the fact that foundry and forge irons are nowhere accumulating, and that furnaces are pressed to get forward deliveries on contracts. Although buyers have persistently held aloof for six weeks, and active bear influences have been at work, prices have been firmly held. The avoidance of a strike in the Connellsville coke district, with the probable advance in the price of coke, will remove another element of uncertainty, and further enhance the cost of pig. It is thought that another buying movement must set in soon, and if the demand is what many expect, there will be another upward turn in prices. Southern makers hold firm to their schedule and decline to make concessions. There is not much speculative iron offering. "We are unable to report any change in the condition of the market," write Wm. F. Jarvis & Co., of Detroit. "It is practically a game of endurance between the buyer and seller. There must be, within a comparatively short time, considerable iron bought. Many of the furnaces claim that they have orders enough ahead not to bother about taking more for the next sixty days. If this is a fact, we think that the furnaces will prove the stronger, and that buyers will be forced to take offered figures. At the same time, there are not a few furnaces who are decidedly weak in their position, being anxious to sell at reduced prices from quoted rates. Lake Superior charcoal is practically where it has been for the last two weeks. The outlook for the maintenance of prices for this grade of metal is better perhaps than for any other on the list. There have been no transaction of any magnitude for a week past, but a few inquiries for round lots have been received, which may result in having the actual figures of the market defined more clearly." The Louisville market is showing some activity, and inquiries are coming in more freely than at any time during the last six weeks. Some manufacturers find that they have sold their finished product to an extent that makes it wise to buy for future delivery to cover sales made. It looks as if the dullness which has existed since the middle of December would soon pass away, and that buyers would purchase more freely without fear of any serious decline. It is believed that during the Spring prices will advance again, and that before the close of the year the market will show a much higher range of values. The figures at which some of the leading Southern companies are holding, practically shut them off from many Northern points where they naturally have to compete with Northern metals. Some of the buyers who have been looking for a break in prices at Chicago, as the result of the quiet market since Christmas, are disappointed. Values in the main have held up well. Foundries are taking iron rapidly on old contracts and will shortly have need to replenish stocks. Here and there a speculator or weak-kneed furnace-man has been running around with small lots at cut prices, but the effect, while disquieting, has not been marked. Lake Superior charcoal furnaces were perhaps never sold so extensively ahead as at this time. Good Ohio softeners are in steady demand. Current business continues in small lots and at practically unchanged prices. Enquiries during the past week at St. Louis, have been somewhat larger than in January, but there continues to be a gap between the demands of Southern furnaces and the figures that consumers seem willing to pay. A few so-called outside lots, on which cut prices have been made, are magnified, reported over and over again, causing consumers to think the market weaker than the facts justify. Most of the Southern furnaces are holding up prices firmly, and decline to make concessions. Makers of Ohio softeners are fairly well sold, and their quotations in this market show no signs of weakening. Sales at Buffalo continue for considerable amounts for this time of the year. Many consumers are holding off, however, until in actual want, and buying in car lots for immediate consumption only. The dullness heretofore reported at Pittsburgh, continues unchanged and the desire of some holders of pig iron to secure sales has weakened prices to some extent, so that quotations are a shade lower. The advance in coke, which went into effect on the 10th inst., will however, enhance the cost of iron from 60 to 75 cents per ton, and ought to stop further concession and have a tendency to put prices.

Iron Ore. If one-half the rumors of the sales of mining property prove true, the mining business of the Lake Superior country will soon be under the control of a very few owners, and the multitude of stockholders will give way to half a dozen syndicates. While such a course would, no doubt, enhance the value of stocks, the policy of cornering the ore market is one that must be regarded with grave misgivings. There is little doubt that the mining business is being concentrated into "safe" hands, that is, into pools and syndicates with strong financial backing, and able to buy up paying properties as fast as offered. The danger, which may be distant as yet, but which is sure to come nearer with the growth of the syndicates, lies in the control by a few people of the vast mining interests, and the possibilities offered to people of a speculative turn. It is a question that is beginning to agitate the consumers of iron ore, and while nothing may occur within a year or two to influence the market, the fact remains that with the growth of the syndicates there must come such a suppression of active and healthy competition as will leave the few remaining owners of ore mines to dictate the price. The local market affords some surprises also. Although for two months or more the ore trade professed to be sold up altogether on Bessemers, there is now offered 100,000 tons of that grade out of a single mine, and the next week will see the offering of 60,000 more, of another kind. The ore business is much like the trade in old iron rails—the more there is sold the more is left.

Pig Iron. The slump still continues, but its effect is felt in the absence of sales rather than in the falling off of quotations. The fact seems to be that most furnaces, being sold up pretty well until the close of April, do not care to take large orders at ruling prices, while consumers, having found a weak spot here and there, are slow to give up a point of advantage. The coke question, although settled as between the men and their employers, is as undecided as ever, as relates to the consumers. The settlement of the labor question secures to the coke syndicate steady work during the remainder of 1890, and the price to furnace-men has been advanced, in turn, forty cents a ton, to hold good during February only. This makes the price $2.15 at the ovens, but the chances are that coke will be much higher this year. Furnace-men are unable to secure contracts, even at $2.25 for the remainder of the year, and great uneasiness is felt in consequence. With large stocks of ore, bought at an advance over last year, the furnace interests find themselves confronted with the uncertainty of getting their fuel at a reasonable figure. All in all, the situation is not a very pleasant one.

THE RIGHT PREMISES, BUT THE WRONG CONCLUSION.

We find this in a recent issue of the Duluth (Minn.) *News*:

"The most remarkable fact in connection with the iron business to-day," says *The Iron Trade Review*, "is the unprecedented activity among furnace plants. On the first of January, 333 furnaces, with an aggregate weekly capacity of 174,038 tons, were in blast, compared with 285 furnaces of 141,419 tons six months ago. Yet, despite this enormous production, the unsold stocks on hand January 1 were only 187,977 tons. Fully as remarkable is the additional fact that, even with practically all the furnace capacity of the country in full blast, the demand for iron is so great that nearly thirty new furnaces are now building, most of them in the South, and a third as many more are either contracted for or under consideration. Adverting to these facts, the Baltimore *Manufacturers' Record* says: 'Had not the marvelous resources of the South been developed when they were, the world's supply of iron would not have been nearly sufficient for the demand. Nothing more forcibly illustrates this than the fact that a year or two ago Great Britain was shipping immense quantities of iron to this country, while only last week an order was received in this country from England for 50,000 tons of iron, to be delivered at the sea-board and paid for as received, and yet the order had to be declined.'"

Not an American but reads with wonder and pride such statements, indicating, as they do, most extraordinary prosperity. But one can't help wondering, in view of the illimitableness of our resources and the vastness of the fields opened up for the manufactured product, upon what the high tariff men base their demands, not only for the maintenance of the present tariff, but for an increase. If figures express facts, the statements of the *Review* and the *Record* proclaim the independence of American manufactures and commerce, so far as they relate to iron, from artificial encouragement. The farmer who is forced to sell his wheat, oats and corn and barley in the "home market," at prices established by Liverpool, begins to discover that there is a hole in the tariff millstone. When will they be able to see through it?

One question: Could such encouraging things have been written of the American iron trade in the year 1890, but for the beneficent influence of a protective tariff? If so, why abandon it for a mere theory?

A PROBLEM FOR CANADIAN IRON MINE OWNERS.

The discussion of the Canadian iron duty is waxing warm across the border. Newspapers of all shades of opinion are taking a hand in it. By far the ablest exponent of the Protection idea is the *Canadian Manufacturer*, whose columns fairly bristle with argument and repartee. One phase of the question is discussed, and the tables are neatly turned on an advocate of reciprocity, in the following paragraph from the *Manufacturer*:

Mr. T. D. Ledyard says that the rich Bessemer ores of the mines near Peterborough, Ont., can be laid down in American lake ports, duty paid, at about the same cost as Lake Superior ores of equal quality and value; and that gentleman has stated that these Peterborough ores can be laid down in certain American cities at the following prices, duty paid: Buffalo, $3.25 per ton; Pittsburgh, $4 75, and Cleveland, $3.90. According to a late report of the condition of the Cleveland market, as given by *The Iron Trade Review*, the average value of Lake Superior ores in that market was about $6 per ton, the product of the Republic mine being quoted at $7. It is claimed for the Peterborough ores that they are the equal of any produced in the Lake Superior region, and if this is a fact, and if it is a fact that the Peterborough ores can be laid down in Cleveland at less than $4 a ton, duty paid, Mr. Ledyard could do a neat stroke of business by sending the million tons of ore he has in his Peterborough mine, which lies within a hundred feet of the surface, to Cleveland, where he could realize a profit of $3 a ton.

If Mr. Ledyard's figures are correct, viz.: that he can lay down his ores in Cleveland at $3.90 per ton, duty paid, he can well afford to pay the paltry duty of 75 cents, in order to realize a profit of $2.50 to $3.00 per ton; yet we have not recently heard of any shipments from the Peterborough or any other Canadian mines to any perceptible amount. Something must be wrong somewhere.

THE AGE OF STEEL STATISTICALLY CONSIDERED.

There is an interesting article in the new number of the *Quarterly*, in which the writer traces recent developments in the manufacture and use of steel—a development so extensive in comparison with that of all previous periods as to justify us in regarding the present time as "The Age of Steel."

The extreme rapidity with which steel has superseded iron for shipbuilding is the more remarkable when we remember that it is the development of scarcely more than a single decade. Between 1866 and 1876 only three small ships were built of steel in the United Kingdom, and the decision to build the Cunarder Servia, launched in 1881, of steel was, even at that recent period considered a very bold one. In 1878 the quantity of steel used for steamships was only 2,682 tons, against 243,717 tons of iron; but in 1887, 195,907 tons of steel were used for steamships, 14,333 tons for sailing vessels, and only 24,052 tons of iron for steamers and 28,150 tons for sailing ships. That is, in 1878 there were ninety times as much iron as steel used for steamers, but in 1887 there were more than eight times the quantity of steel used, as compaared with iron, for the same purpose; and, as regards sailing ships, the quantity of steel used in 1887 amounted to practically one-half that of iron.

The development in the use of steel for guns has been equally remarkable. Krupp produced a cast-steel gun as long ago as 1841, but in that year he employed only 72 men. At the time of his death, which occurred in July, 1887, 12,600 men and officials were employed in the Essen and affiliated works, while the number of those engaged in mining and other operations connected with the firm completed a grand total of 20,000, making the establishment the largest in the world.

After discussing steel rails and steel boilers, the writer goes on to mention, among the lesser known uses of steel, its employment for railway axles. Following the recommendation of Major Marindin, after the Penistone accident in 1884, a board of trade return of engine axles for the year 1883 was prepared. From this we gather that of a total of 14,848 locomotive driving axles in the kingdom 7,422 were of steel. Cast steel is also being employed for anchors. One of the latest uses to which steel is being put is that of replacing cast iron as a material for water pipes. Messrs. Pigott, of Birmingham, commenced making steel pipes in 1880. It is not long since the first pipes of this material used in Great Britain were made for carrying water over the Tay bridge. Steel pipes convey the water under the rivers of Vymwy and Mersey for the new Liverpool water supply. Steel laths for ceilings are largely used in America. Recently a company has been formed at West Hartlepool to manufacture these articles.

In 1876 the total of Bessemer steel in the United Kingdom was 700,000 tons; that of open-hearth steel, 128,000 tons. In 1888 the United Kingdom produced 2,012,794 tons of Bessemer steel ingots and 1,292,742 tons of open-hearth ingots. The production of Bessemer steel in the eight chief iron and steel producing countries of the world in 1887 amounted to 7,269,767 tons. The yield of open-hearth steel in the same countries in 1887 was 1,672,340 tons, against 1,221,921 tons in the previous year. We do not monopolize the steel trade of the world. The annual production of Bessemer steel in the United States already exceeds our own, amounting to 2,936,033 tons in 1887. Decidedly we live in "The Age of Steel."

CONDITIONS FOR THE TESTING OF ARMOR PLATES.

The limit of time for filing intentions to enter into the competitive trials for the testing of armor plates, to be held at Naval Ordnance Proving Grounds, at Annapolis, expired last Monday, but the conditions governing the competition is of great importance, as a perusal of the circular sent out by the Bureau will clearly show. The position taken by Secretary Tracy in his annual report, recommending the immediate construction of an armor-clad fleet, brings the question of armor into greater prominence than ever before, and the coming competitive trials will determine, in a great measure, which type shall be adopted. The accuracy of the tests is to be far greater than has ever been attempted in Europe. At Portsmouth, England, the plates used have been flat and rectangular, 10½ inches thick, 8 feet long and 6 feet wide. Six-inch projectiles of forged-steel and cast iron have been fired at these plates, with a velocity of 1,970 feet per second. Some of these plates have not been penetrated after successive firing. The tests in the coming competitive trials at Annapolis will be upon the same size of plates, but all of the projectiles are to be of forged steel, and their velocity will approximate 2,113 feet per second.

A board of Navy officers will be designated to direct the trials, and the Navy Department will bear the expense of the transportation of the competing plates. Those who present armor plates for testing will be allowed to bolt them to the backing in their own way, with a limit in number and area of bolts. The bolts will not be allowed to be spaced in any unusual way, but their arrangement must conform to the ordinary practice followed in securing armor to ships. As there may be a difference of opinion as to what is "ordinary practice," the person or firm proposing to compete must submit, for approval by the Bureau, a drawing, showing the method of spacing the bolts. This must be done before drilling the holes in the armor plates. Such iron or steel liners as may seem proper to the Board will be interposed between the armor plate and the side plates, and be brought to a firm contact with both by means of wedges of the same metal as the liners. Each plate is to be subjected to five full-force shots, with chrome-steel armor-piercing projectiles of the best quality and of the usual type, each weighted to 100 pounds, and from a six-inch breech-loading rifle. Before the firing test begins, each armor plate is to have traced upon it vertical and horizontal lines, dividing its face into squares of one foot each, and the points of intended impact are to be designated. The party presenting the plate will be allowed to choose, after the second shot, the point of impact for each of of the succeeding shots, but the point so selected must be within one foot of the point described for it by the Board. Each firm will be allowed a representative to be present at the test applied for by such firm, and, at the conclusion of the test, will be furnished with a transcript of the record of that plate, as to the facts only. No representative shall be permitted to witness the tests of other firms than his own, nor to see the official record made as to the other plates, or be furnished with the conclusions arrived at by the Board; but the Bureau reserves the right to make public the results of the tests after they are all completed.

Each manufacturer of plates conforming to the dimensions laid down by the Bureau, manufactured in the United States and made wholly of domestic material, must state, at the time of filing his intention to compete, the price which he will ask for his plate, as the Bureau is authorized to purchase such armor plate as will show more resistance than any other plate, or shall be found by the Board to have shown as much resistance as the plate which shall be adjudged to have done the best on the trial. All plates prepared for trial must be delivered at the places designated for trial on or before May 10.

FOLLOWING the exmaple of Japan, great attention has been given in China to the manufacture of modern heavy guns, which are now produced at the Chinese arsenals with considerable success.

BOILER STEEL SPECIFICATIONS.

The report of the Commitee on Materials and Tests of the American Boiler Manufacturers' Association, presented at its recent meeting in Pittsburgh, if carried into effect, will mark an important step of progress in the boiler-making art. Less than ten years ago the question of using steel for boilers was a disputed one, not because the quality of steel boiler-plate was not as good as it is to-day, but because boiler makers and users had not been fully educated to believe in it. The largest boiler makers in the country still continued to use iron, and refused to consider the question of steel at all. So rapid, however, has been the adoption of steel that a committee of the Boiler Manufacturers' Association now reports that there is no longer any reason why iron should be used, nor why steel should not be used universally.

No doubt the chief cause of this rapid substitution has been the fact that the steel mills have, within the past ten years, provided themselves with such magnificent facilities for handling steel in large masses—twenty-ton open-hearth furnaces, 120-inch three high rolls and the like—that it is now possible to make the best grades of fire-box steel at lower cost than even a fair grade of charcoal hammered iron. Just as steel rails finally drove iron rails out of use, only after it became possible to make steel rails as cheaply as iron ones, so the driving out of iron boiler plate is now taking place, when the price of steel plate becomes cheaper than that of iron.

It has taken boiler makers and steel makers a long time to fully understand and act upon the fact that the tensile strength of the best steel boiler plate is not any greater than that of charcoal iron plate. When steel was first introduced, about thirty years ago, one great argument for its adoption was that it was so much stronger than iron that a lighter boiler could be made of it. Steel was used having a tensile strength of over 80,000 pounds per square inch. The result was that the plates were so brittle that many of them failed before they were even riveted into the boiler, and many serious accidents resulted. Such accidents gave a bad name to steel, and delayed for a long time its general introduction.

Gradually, however, one steel manufacturer after another learned that to make good boiler plate, carbon and phosphorus must be kept down to very low limits, and tensile strength be sacrificed. The Otis Steel Works, of Cleveland, O., were among the first to recognize this, and the splendid reputation that company obtained more than ten years ago was due chiefly to that fact.

The report of the committee above referred to has set the seal of its condemnation upon the notoriously incorrect shape of the grooved test piece which is specified in the rules of the United States Treasury Department for the inspection of boilers used in steam vessels. It is strange that this form of test piece should have been permitted to remain in use for so many years, and it marks the perfunctory apathy in the execution of the duties of the supervising inspectors that they should not themselves have made an effort to get the rules amended, so that when they reported the strength of a piece of boiler plate tested, they should not have been compelled by law to report a highly exaggerated and incorrect result. The committee favor the shape used in tests for the United States Navy, which is in use also in Great Britain and other foreign countries. On this test piece the committee specify that the metal shall show the following physical qualities:

The tensile strength shall be from 55,000 to 65,000 pounds; the elongation shall be twenty per cent. for plates ⅜ inch in thickness or less, twenty-two per cent. for plates from ⅜ to ¾ inch in thickness, and twenty-five per cent. for plates over ¾ inch. The reduction of area test is condemned as unreliable. Good boiler steel, up to ½ inch in thickness, should be capable of being doubled over and hammered down on itself without showing any signs of fracture, and above that thickness it should be capable of being bent round a mandrel of a diameter equal to one and one-half times the thickness of the plate to an angle of 180 degrees without signs of breaking.

These specifications ought to be complied with by any manufacturer of boiler plate steel without difficulty, but the following recommendation, we think, will cause trouble to both the steel maker and the boiler maker:

"We recommend that all tests be made at the steel mill. Three pulling tests and three bending tests shall be made from the plates of each heat. If one of these fails the manufacturer shall have the right to prepare and test a fourth piece, but if two fail the entire heat to be rejected. When a member of this association orders a lot of steel from a steel manufacturer he shall be entitled to receive a certified copy of the chemical and physical tests of the heat from which his plates are made, which must conform to the above requirements. It is, of course, understood that all boiler steel must be made by the open-hearth or crucible process."

The rejection of a whole heat of steel because two plates rolled from it have failed does not seem to be a correct way of sorting good from bad steel. It may happen that two plates rolled from one or two ingots and finished rather cold might just fail to show the right percentage of elongation, while the plates from all the rest of the heat, being finished hotter, would be more ductile. On the other hand, the test pieces might be taken from a hot finished plate which might show the ductility called for in the specifications, while all the other plates of the heat, which, if tested one by one, might show insufficiently ductility, are passed without test on account of the good behavior of the test piece. If a complete check must be had on the steel maker it will be necessary to test a piece cut from each plate. This is the custom in some of the largest boiler works and ship-yards in England, and is, we believe, followed by the Pennsylvania Railroad Co. in their contracts.

In one steel works in this country the custom in making boiler plate steel is to test each heat as it is made for carbon percentage, and mark the ingots of each heat with the serial number of the heat. When an order to roll ingots into plates is given, the ingots are selected which have the proper carbon percentage for the particular grade of steel called for, as "fire-box," "flange," or "shell." When they are rolled the plates are marked to identify their carbon percentage. On shearing the plates to size a piece is cut from each, which is tested by the bending test, and by the testing machine, if required by the customer.

In addition to the report on steel for boilers, the committee have made a most important recommendation concerning the use of cast iron in boiler making. They say: "The unanimous opinion of all parties is that the use of cast iron in mud drums, legs, necks, headers, etc., and in any part of boilers where it will be subject to tensile strains, is dangerous, and should not be permitted. For handhole plates, crabs, yokes, etc., of manheads it may be used, but only a superior article, such as is generally known as 'gun metal,' should be thus employed, *i. e.*, a metal of soft gray texture and of a high degree of ductility."

This condition of cast iron in parts of boilers subject to pressure has recently been emphasized by an accident to one of the well known types of water tube boilers in the Edison electric light station in Kansas City. Four of the upright sections or headers burst simultaneously, the front doors were blown off, and two of the attendatns narrowly escaped death. It is time that in this country these parts of sectional boilers were made of wrought iron and steel, as they are now being made in Europe.—[Engineering and Mining Journal.

CASTING GREAT GUNS IN RHODE ISLAND.

The twenty-fifth mortar of the thirty that the government ordered last year of the Builders' Iron Foundry, Boston, Mass., was successfully cast the other day, says the Boston *Advertiser:* The work is being done under the inspection of ordnance officers, Capt. A. H. Russell, Lieut. D. A. Howard and Sergt. Flynn. The guns are known as 12-inch, breech-loading rifled mortars, cast iron, hooped with steel. The first contract is to be fulfilled April 2, 1890. The first casting, an experimental one, was made March 12, 1889. This was cut up into many pieces for tests, to ascertain the mechanical properties of the iron used and for information concerning initial strains in the mortar body, produced by cooling from the inside of casting. All the requirements of the ordnance department were satisfactorily obtained in this casting and following it as a standard, the first casting to be used as a mortar body was poured April 6, 1889, since which time castings have been made at stated intervals. When it is considered that these mortars, when fired, are expected to put their shot within a target 10 feet wide, the accuracy with which they must be bored, rifled and mounted can be imagined. Much new machinery for this work is now being delivered, consisting of milling, slotting, boring and turning machines, gun lathes and rifling attachments. During the war this establishment built many of the heaviest naval guns, but the changes that have taken place in gun making since that time necessitate entirely different machinery. These mortars are intended entirely for coast defense, and the fortifications already contemplated include many hundreds of these guns. In anticipation of this need the Builders' Iron Foundry is building up the largest private gun manufacturing plant in the country. The mortars are 11 feet long, and with the steel hoops shrunk on weigh 15¼ tons each. They are designed to be operated in groups of 16. They will be hidden from the enemy, by embankments over which they will be fired. The firing will be directed entirely by one officer, who, by previous study of a chart, can put his shot in any section of a harbor he chooses. The regular charge is 80 pounds brown prismatic powder, giving a muzzle velocity of 1,150 feet, the projectile weighing 630 pounds, with a pressure of about 28,000 pounds per square inch on the powder chamber. The range of these mortars with this charge and projectile, with an angle of 45 degrees, is about six miles. The shot at that distance will pierce six inches of steel armor plate. The accuracy of fire is such that with ordinary care every shot can be delivered at this distance within an area covered by the deck of any ordinary vessel.

New Ruling on C. O. D.

The commisioner of internal revenue has recently made the following ruling upon the "C. O. D." question: "I am of the opinion that when a person makes a bona fide offer to purchase goods, and directs in the same order that the goods shall be sent by a common carrier or any one else to a place designated by him, the price to be paid at the place of delivery, and the order is accepted by the seller, and the goods are separated from the other goods of the purchaser, and are delivered to the carrier with instructions to deliver to the purchaser at the place named by him, and collect the purchase money at that place, that the place of sale, under the law of Congress imposing a special tax upon wholesale dealers, is the point at which the goods are ordered, and set apart and delivered to the carrier. The true test is, was the offer on the part of the purchaser a bona fide offer to buy and was it so accepted by the seller. If the purchaser should decline to receive the goods and pay for them, could the seller main an action for the price thereof? Any other rule, it seems to me, would be doing great violence to the acts of Congress imposing these taxes."

New Basic Lining for Bessemer Converters.

To the Pottstown Iron Co., of Pottstown, Pa., has been assigned a patent, dated January 14, 1890, for a basic lining for Bessemer converters, invented by Ernst Bertrand, of Kladno, Bohemia. His plan is to grind dolomite or limestone thoroughly, mix it with water, and, with or without an adhesive substance, like molasses, form it into bricks. The latter are burnt at a white heat for about forty-eight hours in a kiln. These burned bricks are again ground and mixed with ten to twelve per cent. of tar, the product being used to ram up in the converter. Bertrand claims that the preparatory grinding of the stone into brick, the baking of the latter and grinding the burned brick, yield a product more homogeneous than can ever be obtained from the cupola or kiln burned dolomite. He claims, too, greater accuracy of material, because there is always a loss of the fine stuff which must be thrown away because it cannot be freed from cinder.—[Iron Age.

THE MULLER BASIC PATENT.

We print below the text of a patent granted to A. Muller, dated March 12, 1869, for the manufacture of magnesia linings for Bessemer converters and Siemens-Martin furnaces.

It is strange that this patent has attracted so little attention, for in it we find for the first time a thoroughly well defined, practical process of dephosphorizing by means of basic linings and basic additions. Attempts at dephosphorization had been made and basic additions other than iron ore had been proposed, but the linings remained siliceous.

A. Muller was a manufacturer of ornamental terra-cotta and fire-brick in one of the suburbs of Paris. His business brought him in contact with metallurgists, and impressed by Gruner's remarks on the necessity of a basic slag in the purification of iron, worked out the method he patented. In 1868 he manufactured magnesia bricks, some of which are still in existence and intact. He proved the possibility of dephosphorization in a practical furnace and called the attention of steel manufacturers to his results; but he was too early in the field, for at that time metallurgists thought that purification was impossible at the temperatures obtaining in the Bessemer and open-hearth operations. Besides, Muller was not considered a metallurgist and his proposition never received the attention it was entitled to. The Franco-German war prevented all further efforts for a considerable period, and disgusted with the indifference of those who should have been most interested, he abandoned his patent by non-payment of the yearly tax.

Thus did the man who first promulgated a practical method of dephosphorization by the use of basic linings and basic additions fail to reap where he had sown. He was ten years too early, and it is quite as bad as being ten years too late.

The following is a translation of the patent:

"This invention has for its object the novel use in processes for pig iron refining (known as Bessemer or Martin process) of magnesian refractory products which cause diverse modifications in the reactions transforming pig iron into iron and steel.

"The result which I propose to obtain is to more completely rid the product of the sulphur, and, above all, of the phosphorus contained in the pig, and moreover in the Martin process, to prevent the rapid destruction of the furnace by the oxide of iron likely to be used.

"Instead of making the inside lining of these apparatus of ordinary refractory products—namely, of silicate of alumina, containing or not containing a greater or less quantity of free silica—I construct these of pure magnesia, or, at least, of magnesia containing but small quantities of foreign bodies.

"The result is that the silica of the slag will come solely from the silicon of the pig, and consequently it will be in limited non-renewable quantity. The result is therefore: 1. That the slag will be basic; for even though the oxidized metals form acid slag, the magnesian lining of the apparatus will always bring it back to the basic state by its own partial destruction. 2. That the phosphorus will pass to the state of phosphate into the basic slag and will thus be eliminated, while, if formed at all, it is always decomposed by acid slags. 3. That the elimination of sulphur, which is complete only when the pig iron contains but little, will be facilitated in very sulphurous pigs, either by direct oxidation, by means of basic silicates, melted oxides, etc., which can take place only in the presence of a basic lining, or by a greater proportion of manganese, an even weight of which forming a less abundant slag; or, again, by the formation of an alkaline sulphide with the magnesia of the lining."

The following is an "additional certificate" to the above patent, which was filed March 17, 1869:

"This 'addition' bears upon one of the very advantageous consequences of magnesia used as a lining; it allows the adding into the apparatus of certain bodies capable of maintaining basic slags by being dissolved as the lining itself would be, such as, for instance, quicklime, magnesia in lump or powder, etc.

"By this means the magnesian lining would last a longer time, as it would be attacked mechanically only, so to speak.

"By this 'addition' (to the original specification) I mean to patent not the use already proposed of certain oxidizing bodies capable also of giving a basic slag, such as nitrate of potash, nitrate of soda, etc., but to render possible the use of these bodies by the fact of the magnesian lining.

"In an ordinary sileceous lining the alkalies resulting from the decomposition of these bodies are always saturated by the relatively considerable proportion of silica in the lining, so that while the oxidizing action is produced rapid destruction of the inside takes place as well.

"With a magnesian lining, on the contrary, the oxidizing action will take place just as well, but the alkalies will contribute to render the slag basic without destruction of the lining."

Invention for the Recovery of Valuable Metals.

An apparatus for the abstraction and recovery of valuable metals from earth, sand, clay, slag, the sweepings of jewelers' shops and other refuse, has just been perfected by Mr. T. Budworth Sharp, Muntz's Metal Works, Soho, and son of the late head of Sharp, Stewart & Co., Manchester and Glasgow. The machine, which is termed the "hydraulic separator," consists of a tube of two chambers. Into the upper chamber the refuse is introduced, whilst water is slowly rising in the lower tube at a regulated speed, and, while the metals sink into a receptacle, the earthly particles are carried over the top of the tube into the refuse tank. The principle on which this invention is based is that, assuming certain metal particles sink in still water at the rate of thirty feet per minute, whereas earth sinks at the rate of twenty feet, it follows that, if the water is caused to rise in the tube at the rate of twenty-five feet per minute, the metal will sink to the bottom at the rate of five feet per minute, whilst the particles of lighter specific gravity are washed away. The machine is exceedingly simple of construction, requiring no skilled labor, and, it is stated, the economy is such that at one of the leading works in the Midlands metal of the value of several thousand pounds is annually recovered. The invention is not only valuable for coppersmiths, brass founders, tinplate manufacturers and jewelers, but it is claimed to be most effective for gold mining purposes, and several of these hydraulic separators are now on their way to the South African gold fields. The invention has been patented in Great Britain and most of the leading foreign countries.—[Exchange.

A Gigantic Railroad Tunnel at Port Huron.

Six hundred men are now digging the railroad tunnel under the St. Clair river, at Port Huron, at the rate of fifteen feet each day. This means that before the year is out one of the most important pieces of civil engineering in the country will be completed. More than 1,200 feet of the tunnel proper is now ready for trains on the Michigan land side, and 900 on the Canadian. The remaining 4,000 feet will be finished at a wonderfully rapid rate, considering the nature of the work, if no accident intervenes. It has taken six months to do the work thus far, but workmen are now more accustomed to the task and can work with greater facility in the use of the machinery, so that the engineers in charge place the completion of the work not later than the end of the year.

The tunnel itself is over 6,000 feet long. The approaches are equally long, so that the entire length will be more than two miles. Of this distance 2,310 feet are under the river, 2,390 feet on the Michigan side, and 2,100 on the Canadian. The grade is one foot in every fifty, except under the river bottom, where it is substantially level. It is an iron cylinder tunnel, the only one of the kind in the country. There is neither brick nor stone used in its construction. Neither are there any stays or supports—simply a mammoth iron tube built in sections underground. It is designed for a single track.

Electric lights make it as light as day, air engines keep the atmosphere as healthy inside as above, and steam pipes hold the temperature at the proper point. It is as dry as a street in summer, and the disagreeable features common to subaqueous work are entirely absent. Work is pushed from both ends.

A Large Phosphor-Bronze Casting.

Messrs. Steven & Struthers, brass founders, Glasgow, have successfully completed the first of several phosphor-bronze castings, which are interesting in view of their size and weight. It was decided by the Admiralty to have several of the second-class cruisers recently ordered wood-sheathed and copper-bottomed. As the copper would result in the corrosion of steel by galvanic action, it is necessary to make the stem and sternposts of phosphor-bronze. The stem of one of the vessels has been completed. It weighs over 10 tons, and, from the connection with the built keel to the point of the ram, the measurement is 23 feet six inches, while the height from the ram to the top of the stem is 20 feet, making the length from tip to top 43 feet 6 inches. The stiffening bracket, in connection with the ram, forms part of the casting, and is not, as is usually the case, separate and bolted to the stem. At its broadest part the stem is three feet, and is scarfed for the steel plates and teak planking. The principal casting of the stern framing, the first of which is now in progress, will weigh 12 tons 5 cwt. To it are fixed two brackets for the propeller shafting tubes, each bracket being 4 tons 10 cwt.; while the rudder, on the balance principle, will be 10 tons, making in all 31 tons 5 cwt. The larger casting, in connection with the sternpost, measures, from point to point, 35 feet 6 inches. The rudder is cast in frame, and plated with bronze sheeting ⅜ inch thick. It may be added that the metal is composed of 90 per cent. copper, 9.5 per cent. tin and .5 per cent. phosphor. The castings for each ship will cost about £2,200.

Narrow and Broad Gauges.

It is said that Col. Conway Gordon has laid a proposal before the government of India to the effect that keeping up two gauges is a most wasteful proceeding; that endless delay and friction arises in discussing the question of which gauge any new line is to have; that, in point of fact, there is so little economy in the first cost of the metre gauge that the advantage is invariably lost in working expenses; that it is a matter for regret, but a now quite vain regret, that India has not got the same gauge as the 4 ft. 8½ in. that suits the rest of the civilized world so well; that, failing in the 4 ft. 8½ in., there is no salvation for Indian finances in any gauge but the 5 ft. 6 in., but that, as a matter of practical politics, he reluctantly consents to except certain geographical divisions of India from the operation of what he would else make a universal law, compelling all new schemes to adopt the 5 ft. 6 in. gauge *ab initio*. Perhaps the very strongest argument of all is the fact that the very administration which has made the metre gauge so much of a success, as it undoubtedly is on the Rajpootana line, is at this moment busily prosecuting the construction of a new line to relieve its congested traffic, and making it on the broad (5 ft. 6 in.) gauge.—[Engineering.

To Cement Iron to Iron.

There is a mixture which has been highly recommended for cementing such work as iron railing tops, iron gratings to stoves and the like, and is said to set so hard and form a union so intimate with the adjacent metal as to resist the blows of a sledge hammer. This mixture is composed of equal parts of sulphur and white lead, with about one-sixth part (by weight) of borax, the three ingredients being thoroughly incorporated together so as to form a homogeneous mass. When the application is to be made of this composition, it is moistened with strong sulphuric acid and a thin layer of it placed between the two pieces of iron, these being at once pressed together. In five days, it is said, the cement will be perfectly dry, all traces of the same having vanished, and the parts will have the appearance of being united by welding.

FOREIGN COMMENT.

Spanish Iron Minerals.

The exports of iron minerals from Bilbao last year amounted to 3,854,635 tons. The corresponding exports in 1888 were 3,580,425 tons.

The World's Consumption of Coal.

The German *Handelsmuseum* reckons that the steam engines of the world come to ten million horse-power; that these use about 12,000 tons of coal per hour, on an average; that gas lighting consumes 10,000 an hour; gas engines 4,500 tons; iron smelting 5,000, and other metals 4,000 tons an hour; other factories, 5,000 tons, and domestic heating, 10,000 tons an hour; all which comes to over 50,000 tons an hour. On the other hand, the whole output is 550,000,000 to 600,000,000 tons per annum, or about 65,000 tons per hour.

Basic Slag for Manurial Purposes.

Professor Dobbie, of the North Wales University College, Bangor, has just made a report upon a series of elaborate agricultural experiments which have been carried out, in connection with the agricultural department of the college, upon Derwendeg farm, near Welshpool, Montgomeryshire, in order to test the value of the new form of phosphatic manure known as "basic slag." The results of the experiments have been carefully tabulated, and the general conclusion arrived at is that basic slag is a valuable form of phosphatic manure for arable, pasture and meadow land. Professor Dobbie is of opinion that for poor pasture it is one of the best manures at the command of the farmers.

The Forth Bridge Tested.

The Forth Bridge was officially tested this week, and the result was entirely satisfactory. The following is the official note of the result: Sir John Fowler and Mr. Baker, engineers of the Forth Bridge, tested the two 1,700-foot spans by placing on the centers two trains, each made up of fifty loaded coal wagons and three of the heaviest engines and tenders—the total load thus massed upon the spans being the enormous weight of 1,800 tons, which is more than double what the bridge will ever be called upon in practice to sustain. The observed deflections were in exact accordance with the calculations of the engineers, and the bridge exhibited exceptional stiffness in all directions. The bridge is to be formally opened by the Prince of Wales on March 4th.—[Iron and Steel Trades Journal (London).

A Coke Famine.

A more serious famine is presenting itself in the West coast district than that which was some time ago threatened in iron ore, and which to a great ex ent has been experienced, and this is the sudden scarcity which has arisen in the supply of coke. The North-west district is chiefly supplied with coke from the Durham and Northumberland coal fields, but burners of coke there have had their hands too full of orders to cope with the trade which has sprung up in connection with the iron trade generally. The ovens are producing the maximum amount of coke, and there is no prospect for some time to come, at least, of any increase in the production. Some of the furnaces in the West coast district have been at a standstill through small supplies of coke, and makers of iron have had to seek protection in the getting of large supplies of South Wales coke by sea. But the makers of hematite generally are anxious and ready to put additional furnaces in blast if they can be assured of a regular supply of raw material, and of this there is not much hope at present. In the meantime the value of coke is advancing at an alarming pace.—[Engineer, Glasgow.

Steel Boats.

Mr. Wm. Heslop, formerly connected with the Leeds Forge, is (says the *Ironmonger*) engaged in preparations for carrying on the manufacture of ships' boats out of single plates of steel. Difficulties with the "buckling" of the plate have been successfully overcome, and those present at the testing of the appliances a few days ago speak of it in high praise. It should be explained that they were only capable of making a model two feet in length and eight inches in width. No doubt is entertained, however, as to the possibility of producing a full-sized boat. The dies have simply to be enlarged. The invention involved the taking out of two patents, one for a seamless boat, and the other for the appliances to produce it. Mr. Heslop has disposed of the patent rights for Great Britain, but retains them for foreign countries. It is stated that the seamless steel boat will be superior to the wooden one, will be about the same weight, and the cost of the one will not be much greater than the other. Its power of resistance is very great, as was shown by Mr. Heslop, who placed the boat in a vise and reduced the beam to the extent of one-eighth of the total width. On the pressure being taken off, the frame sprang back to its original width.

The Manufacture of Soft Back Steel.

Mr. M. A. Howell, Jr., of London, has taken out a patent for improvements in the manufacture of soft back steel. The invention relates to the manufacture of plates or flat bars of steel, having one side highly carbonized, and the opposite side practically free from carbon. Such steel is said to be less liable to break or crack while hardening, and is more tenacious when in use where great rotary force or heavy blows or strains are required. Plates or flat bars of soft steel or fine iron in pairs of equal size are placed back to back with a film of clay or other refractory material interlaid between them. They are then clamped or wired together and the several pairs placed "in a receptacle or flask stratified between layers of granulated charcoal." The flask, furnished at one end with an inlet tube and cock, and at the other end with an outlet cock, is placed horizontally in a muffle. When the heat of the furnace has raised the temperature of the flask to a low red heat, a current of hydrocarbon vapor is driven over the plates, and when the heat reaches the cherry-red stage, the flow of the gas is diminished and the operation continued until the metal has taken up enough carbon. Finally, the corks are closed, the flask disconnected and allowed to cool in at atmosphere of hydrocarbon. When cool, the receptacle is opened and the plates are taken out and forged, hardened and tempered in the usual way.—[Iron and Coal Trades Review.

The Quality of Steel Rails Made in Germany.

The Berlin Railway Association has recently been discussing the quality of German steel rails. At one meeting a statement that those recently produced were inferior in quality to those of former years was allowed to pass unchallenged, and caused considerable indignation among producers. At the last meeting a paper was read on the subject by a Government official connected with the railways, who was in a position to give figures showing how many rails in each district of the former Rhenish Railway Co., delivered in accordance with contracts, had become defective during the period for which they were guaranteed. In 1868 the company obtained Bessemer steel rails for the first time, and after this it continued to order them from about 15 firms. Delivery was always made under the same conditions and by the same people, so that uniformity was maintained. The particulars of the substitutions which took place under these conditions show that they gradually diminished. From 1868 to 1872 the average number of substitutions was 16; from 1873-77. .075; from 1878-82, .025; and 1883-87, .012 per cent. In the case of the first two periods the guaranteed time is, of course, past, while it is still going on in the two latter. If, therefore, an allowance be made of 20 per cent. on the third, and 100 per cent. on the fourth, the diminution would still be very considerable, which does not seem to indicate any deterioration of quality, but the reverse. The official indeed, stated that it was now very rare for rails to be rejected as defective, and expressed a strong opinion that the quality of German rails had of late materially improved.—[Glasgow Engineer.

The Hematite Iron Mines of Furness.

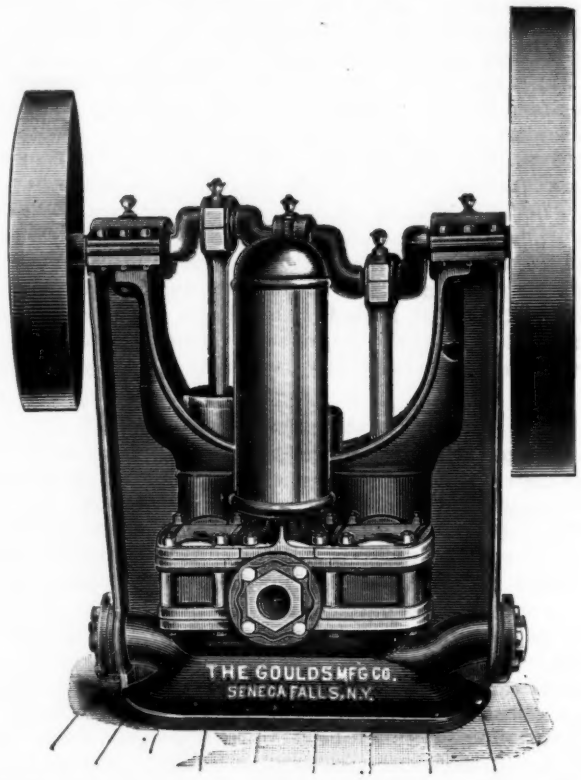
These famous mines are in North Lancashire, Eng., and have long been known for their vast deposits of hematite iron ore. These were the only fields known yielding this class of ore, writes a correspondent of the *Colliery Guardian* (Eng.), until the West Cumberland mines and Hodbarrow were found. The latter is supposed to be the largest and richest iron mine in the world, and it is stated that the royalty on the ore paid to the lord of the manor is £30,000 per annum. The output exceeds 500.000 tons a year. Near it is the celebrated Park mine whose output some four years ago had exceeded 12,000,000 tons since it was discovered. The average profits—which at a low estimate cannot have been less than 3s. per ton—with the royalty paid, has been put at over £80,000 per acre of surface. The present output averages 320,000 tons. Adjoining this mine is the Ronhead mines, discovered about 1842, the output of these being about 220,000 tons. There are also the Lindal Moor, yielding its 300,000 tons, the Stank Mine, throwing up to its surface, some 130,000 tons yearly, and there are many others of lesser magnitude, all of which bespeak the richness of the district, and whose owners and lessees have been styled the iron king of Furness. The Parkside mine was discovered some fifteen or sixteen years ago at a depth of not more than 100 ft. from the surface; the average output has been 25,000 tons, and the surface area of the mine does not much exceed, if at all, one acre of land. One great advantage of the mines lies in their permanency. When once found the fissures or veins are filled with the richest hæmatite, and are, as a rule, nearly perpendicular, so that when one height of workings is got out another may be sunk to. The only embarrassment is the water, which is sometimes very heavy. The largest deposit, is generally found in the limestone formation so far, but it is found in the rocks of nearly all the series abutting the hills of the Lake district. Even in the granite rock veins have been found filled with rich ore, as also in the silurian slate, and the new red sandstone.

Power for Isolated Machines.

The following note is condensed from a recent article in the *Iron Age*: It seems to be the tendency at the present time to provide each machine with an individual or independent power for driving. The methods may be divided into steam, air and electricity. When power is solely for the propulsion of one machine it is quite under the control of the operator using that machine. This does away with expense, constructive and operative, connected with shafting and reduces materially the wear and tear. The machine is used only when needed, and all expense ceases when the machine stops. Compressed air has been considerably used in Paris. The advantages derived from its use are not equal to the disadvantages from the necessary piping peculiar to the machine itself and the deficiency in the power obtained. The electric motor, as a self-regulating machine, is beyond all doubt superior to any other machine in the market for the generation of power. It will transmit 92 to 93 per cent. of the work in the current delivered to it. Again, it requires no attendance except occasional oiling; wear and tear is reduced to journal wearing, and it requires no piping to carry away hurtful gases. In point of regulation it is as effective as the best steam-engine governor. As now built it is guaranteed to run within two per cent. of the speed regulation provided by the contract. The good points of the electric motor are not appreciated as they should be, and it would be more extensively used if it its driving shaft were reduced in speed. The mechanic looks with suspicion upon a speed of 1,500 revolutions a minute. Another feature which acts against the introduction of the electric motor is the first cost. Considering the horse-power derived from it and the cost of construction, this is unnecessarily high. What we want is a low speed, moderate cost, electric motor.

GOULD'S DIRECT TRIPLEX SUCTION AND FORCE PUMP.

The accompanying cut represents Gould's direct triplex suction and force pump, with outside packed plungers, for high pressure service, and pulley and fly-wheel. The manufacturers claim that this type of pump have never before been built in this country, though they have been long and favorably known in England and Germany. Among the special features which the makers claim for this type of pumps are that the pumps have hand holes for easy access to all valves, which are of hard rubber of spiral springs, similar to steam valves, with composition grid seats. The plungers reciprocate through carefully fitted glands, and will move either hot or cold water (the former under proper conditions), no matter how dirty or gritty, semi-fluids and the like without cutting. The main casting consists of three heavy cast-iron cylinders, truthfully bored, reamed and polished, with outwardly extending supporting arms for the crank shaft, which runs in babbited boxes; crank shaft, of best steel, is adequately heavy and has journals precisely 120° apart in the circle it describes, to which are connected the plunger rods with



babbited boxes and caps. Suction can be had at either end of bed plate, one of which openings has a blank, and the discharge is from the side or top of a large air chamber, as most convenient. A babbit metal sleeve surrounds the pin, tying the plunger and connecting rod together, which, when worn, can be replaced—thus providing an easy and cheap means of taking up the wear. One cylinder of this combination will, from the nature of things, be always taking and delivering water, for the very instant one crank has made one-third of a revolution, another follows immediately, and that by the third; so that there are no points of uneven resistance, no hitching, jerking or hammering, no break in the ingress or egress of the water, and a supreme efficiency of applied power is obtained, thus giving a smooth running and even moving pump. They also claim that this pump is suitable for almost any duty, except under constantly varying loads and extreme pressures. The heavy turned and finished balance wheel is the best of governors and materially aids the working of the pump in equalizing the load and speed under all conditions. Power may be transmitted from any of the high speed motors to pulley on countershaft, thence to pump pulley, the several pulleys so proportioned to give speed recommended in our tables. For further particulars, address the manufacturers, The Goulds Manufacturing Co., Seneca Falls, N. Y.

Import of Metals into Canada.

We show in the following table the imports into Canada of iron and steel and metals for the eleven months ending November 30, in comparison with the same period of 1888:

Iron and steel.	1888.	1889.
Pig iron, tons	48,762	51,428
Bar, angle, bolt, rod	20,148	9,248
Railroad of all sorts	79,756	110,645
Hoops, sheets, boiler-plates	17,556	17,555
Tin plates and sheets	19,276	14,772
Cast and wrought	19,399	11,401
Steel, unwrought	19,327	16,607
Lead of all kinds	2,332	4,376
Tin, unwrought	6,906	6,798

Following is a table giving the values of these various articles for the same period:

Iron and steel.	1888.	1889.
Pig	$ 552,220	$ 630,765
Bar angle, bolt, rod	510,820	307,045
Railroad of all kinds	1,752 155	2,662,275
Hoops, sheets, boiler-plates	795,190	88 ,350
Tin plates and sheets	1,371,575	1,026,076
Cast and wrought	790 635	614,880
Steel, unwrought	774,405	747 635
Lead, of all kinds	162,450	288 030
Tin, unwrought	209,030	162,530

It will be seen from these, that the consumption in Canada of pig and railroad iron has been greater this year than last, railroad iron showing a marked increase. To show the extent of the late advances more fully, it is only necessary to mention that while imports of lead decreased 174 tons, the value increased $25 580, and that while imports of sheet and boiler plates decrease by one ton, their value this year was $87,160 greater than last. Importations of pig iron and railroad iron were greater this year, but decreases may be noted in bar, angle, bolt and rod iron, tin plates and sheets, cast and wrought iron, unwrought steel, lead and unwrought tin.—[Hardware, Toronto.

BICYCLE MANUFACTURE AT TOLEDO, O

Within the past ew months an important industry has been developed at Toledo, O., by the Lozier & Yost Bicycle Manufacturing Co. This company has been organized by the election of Mr. H. A. Lozier (of Cleveland), as President; Mr. Jos. L. Yost, as Treasurer and General Manager; Mr. C. J. Moore, as Superintendent, and F. S Hodgman, as Assistant Manager. The works occupied by the company (the only exclusive bicycle manufactory in the country) are very extensive, as will be seen by the accompanying illustration. About 165 men are employed, and 55 machines are turned out daily. Perfect system prevails in every department.

The special machine made by the company is the "Little Giant," for boys, though designs are being made for a bicycle for men. The accompanying cut shows the main features of the "Little Giant." The notable features are: the

Diamond all-steel frame with cold-drawn weldless steel tube back-bone, the Standard cone bearing adjustment to sleeve head, front and rear wheels, pedals and caank shaft, and its general beauty of outline.

A New Metal.

An account of a newly discovered metal or alloy that seems to promise great things, is thus given by the Birmingham (Ct.) *Transcript*. A well-known gentleman has been experimenting on a metal resembling gold for nearly a year, and has now got it down almost to perfection. He stumbled on it at first accidentally, while analysing some metals, and when he realized what he had found, he went to work and soon produced a metal which puzzles the best of jewelers, is as heavy as gold, and to all appearances is the precious metal itself. When the gold test is applied to it, the acid boils up a little, but gives no other evidence that the metal is other than gold, and when wiped off no mark or spot is left, as is the case when the test is applied to brass. It can be manufactured at a cost of about sixty cents a pound, and will make the best foundation for gold plated goods that can be conceived. It is easily worked, and can be drawn or hammered out with little trouble, but is still very strong and hard wearing. The metal is no compound, it being only one kind, and is reduced to its gold-like appearance by the application of a certain chemical The inventor says there is no necessity of his taking out a patent on it, as no one can discover the secret of its manufacture by analysing it. He has recently produced the metal in a reddish color, which has a beautiful appearance. He is still experimenting with it, and expects soon to make a move towards putting it on the market. Within a few years it will be hard to tell a $150 gold watch from one the case of which costs less than $5, when the new discovered metal is produced.

THE Pennsylvania railroad after spending $75,000 in trying to get a satisfactory steam heater for cars, has had to give it up, and says there is nothing that equals the old time stove.

"FRICTION heat," caused by two disks of heavy iron rubbing against each other, is to "take the place of steam, gas, coal and oil."

A CANADIAN VIEW OF THE AMERICAN IRON ORE INDUSTRY.

All the developed evidence points to the fact that there are no considerable influences in the United States that desire to have iron ore placed on the free list. That country now stands in the enviable position of being able to supply about all the ores it needs from its own inexhaustible mines, and to manufacture from them all the iron and steel products it requires. Until recently, it was thought that only limited supplies of steel-making ores could be found in the United States, but it is now known that the Lake Superior region is capable of supplying all the high grade ores required in all the furnaces west of the Alleghenies and north of the Ohio river; while Western North Carolina, Western Virginia, East Tennessee and North Alabama will supply all Southern works with ores of similar value. These Southern ores are found in quantities sufficient to honor all demands that are likely to be made upon them for generations to come; and it is only such works as are situated along the Atlantic coast that will draw upon foreign countries for their supplies. The latter demand is not for very large quantities of ore, and the proprietors of these Atlantic works carry little or no influence in demanding free ores, while all the influence attaching to the home industry, scattered as it is throughout the country, is decidedly against such a proposition. The consumption of iron ore in the United States during the year 1889 amounted to about 15,000,000 tons, of which the Lake Superior region alone supplied 7,000,000 tons; and one-half of all the pig iron made there in that year was from Lake Superior ores The importation of foreign iron ore into the United States amounts to less than a million tons a year, but a very small portion of which was taken from Canadian mines, the supply coming chiefly from Spain and Cuba. The product of the Spanish mines last year was only about 7,000,000 tons—just about equal to the product of the Lake Superior mines—but nearly all these Spanish ores are required for the demands of England, France, Belgium and Germany; and all these countries depend largely upon foreign importations for their steel works. The Cuba mines are owned or controlled by the Pennsylvania Steel Co., who have erected extensive steel works near Philadelphia, depending upon their Cuba mines for their ore supplies.

The history of the iron ore industry in the United States is briefly told. It began about 40 years ago, and it struggled along through the earlier years of its existence under a so-called "protection" of an ad valorem duty of 20 per cent. Iron ore was not mentioned in the Morrill Tariff, but was classed under the section which read "all mineral or bituminous substances not otherwise provided for," the duty being about equal to 45 to 55 cents a ton. It was in view of the large and rapid increase in importations of ore, subsequent to 1880, that the present specific duty of 75 cents a ton was imposed. Under the 20 per cent. duty the industry languished, and the United States was forced to depend, in large measure, upon foreign mines for its supplies of steel ores; but as soon as the specific duty of 75 cents a ton was imposed, new mines were opened, railroads for transporting the ores were pushed through the wildernesses to them, immense fleets of vessels found profitable employment in sharing the transportation with the railroads and every trade and business connected with this industry assumed a most lively and lucrative character. Hon. Geo. H. Ely, president of the Western Iron Ore Association, estimates that the capital now invested in the United States in connection with ore mining, transportation and manufacture into iron amounts to not less than $150,000,000, and furnishing employment to hundreds of thousands of laborers, who receive three times as much wages as are paid for ore mining In Spain and Cuba.

Mr. Ely, speaking of what would be the result if the American duty on iron ore was removed, says, in *The Iron Trade Review:*

"The displacement of American ore by foreign, which would certainly follow the removal of the duty, would have the effect of reducing wages all along the line of this vast combination of ore production and transportation, or of closing many mines and of pushing out the brain and muscle now employed in them to crowd the laborers in other occupations, while much of the capital employed, being immovable, would perish on the spot. But what has been the effect, upon the country and upon prices of iron and steel products, to the consumer of keeping (under the defense of the duty) the home supply of iron ore in all varieties of chemical constitution abreast of the wants of our iron and steel manufacturers? The prices of all iron and steel products have ranged quite low—certainly lower than would have been possible under any dependence upon foreign supplies. Has the consumer of iron and steel products been complaining about the price of steel rails, pig iron, nails, merchant iron, steel and hardware? He knows the effect of giving the home market to iron and steel makers, and how enlargement of production diminishes cost."

This gentleman calls the attention of Western farmers to the fact that, in the good, old revenue tariff times that the Free Traders are so anxious to see returned, in the State of Iowa the price of cut nails was eighteen cents a pound, and it took three pounds of butter to buy one pound of nails; while now, under protection, one quart of skimmed milk will buy two pounds of nails.

It is evident that if proprietors of Canadian iron mines intend to wait until the United States removes the duty on iron ore, these mines will never be worked. As we have time and again shown, many of these Canadian ores are of the very finest and most desirable quality, and fully equal to the best found in the Lake Superior regions, in the South, in Spain or in Cuba. The consumption of iron and steel in Canada, amounts to about 300,000 tons a year, of which less than 50,000 tons of pig iron is manufactured here. Until recently, most of our importations were from Britain, but lately large quantities are brought from the United States. Why should not Canada manufacture all of this 300,000 tons of iron and steel? What made it possible for the United States to become entirely independent of Britain in this respect? Why should not Canada, under similar influences, become equally independent? Canada has within herself all the requisites for the manufacture of iron; and, as we have frequently shown, such pig iron as now commands $20 a ton or more in the market, can be made at a cost not exceeding $14 a ton. What Canada needs is blast furnaces, and iron and steel works—enough of them right now to produce at least 300,000 tons a year.—[Canadian Manufacturer.

COST OF AMERICAN AND ENGLISH LOCOMOTIVES.

When American locomotive builders have succeeded in obtaining contracts for building locomotives for British colonies in open competition with British builders, it has repeatedly led to acrimonious discussions in British engineering journals, and the claim has always been made that American locomotive builders are able to compete with European rivals only by using cheap and inferior material. The claim made by American builders that their superior mechanical facilities enabled them to do the work cheaper than European builders was always ridiculed and called absurd. Yet it is undeniable that when a first-class American locomotive builder undertakes to construct locomotives for foreign countries, and equips them with wrought iron wheel centers, copper fire-boxes and other expensive material called for by English prejudices, he can still beat the European builders on price, although the latter do not pay half as much for labor as what is paid in America.

In spite of the low wages paid to skilled mechanics in Glasgow, the cost of building a locomotive there is considerably higher than it is in the United States. When Bret Harte was American Consul in Glasgow, one of his reports to our government brought this fact out very decidedly, but the accuracy of his conclusions was questioned by those concerned in promoting British interests. We recently learned something that appears to strongly corroborate the correctness of Consul Harte's conclusions. A British locomotive building company noted for the fine equipment of tools used and the advanced system of production followed, built 200 locomotives last year, while employing on an average 2,500 workmen; a well known American firm in the same time built 300 locomotives while employing 1,400 workmen. Allowing 300 days for a year's work, the American firm puts the labor of one man for 1,400 days on each engine finished. At the same rate the British builder puts the labor of one man for 3,750 days on each locomotive sent out of the shop. The weight and power of the American locomotives greatly exceeded those built in the British shop- This is no hearsay matter. It was a comparison made by the chief executive officers of the two works referred to. The British firm follows largely the American practice of production by piece work, and the process of manufacture appeared to be very systematically carried on. There is, of course, a cause for the great difference in rapidity of turning out the finished machine. Many of our engineering readers visited British workshops last Summer and watched the methods of manufacture in vogue. We should be pleased to receive the views of some of them on what they consider the cause of the difference in production.—[National Locomotive and Car Builder.

Pittsburgh Firm Constructing Steamers for South America.

Commodore Arthur Stegman, of the United States of Columbia, is in Pittsburg superintending the construction of two steamers for use in the South American waters. The new boats are sternwheelers. The larger one will be 138 feet long and 27 feet beam, and will be put in service on the Magdalena and Cauca rivers. The other will be 74 feet long and 16 feet beam, to be used on the Lebriga.

The boats will be built to run fourteen miles an hour and will be fitted with compound engines of the most improved type. When finished they will be shipped by rail to New York, and from there will go by steamer to their destination. The cost of transportation almost equals the first cost of the boats, and will make them very expensive by the time they reach South America. One taken down, however, about eighteen months ago, paid for itself inside of a year, and the new ones are expected to do still better. Commodore Stegman, who is an American, and went to Columbia just before the last revolution and won his title there, is engaged in the transportation business. He says:

"Our business is growing wonderfully, and it won't be many years before we shall have a dozen Pittsburg boats in our land. Our traffic is chiefly in carrying coffee, hides, tobacco, gum and Peruvian bark for export and dry goods and machinery which are imported. The universally high tariff keeps out almost everything in the way of importations, and as the natives are not of an industrious or mechanical turn of mind themselves, the progress of the country is very much retarded in consequence. At Bogota the people think a great deal more of literary pursuits than of manufacturing. About all the factories that are now running are owned by Germans or Americans."

Cost of Water and Steam Power.

A thorough examination into the relative cost of water power and steam power has been made by C. H. Manning, in a paper read before the last session of the American Society of Mechanical Engineers. After making elaborate calculations as to the practical additions and abatements required in putting both to use, the author sums up the cost in each case, and says: "In the water power plant, we paid $14 for the cost of the water simply per horse-power per annum; adding to this $8 62, for attendance and supplies, we have a total cost for water power of $22.62 per horse-power per annum. Taking for steam a low-pressure plant of 1,100 horse-power, with compound engines run on 1¾ pounds of coal per horse-power, with coal at $4 50 per ton, the total cost for steam is given at $21.16 per horse-power per annum. On a 100-horse-power plant, the difference in the cost saves an engineer's wages."

WEST SUPERIOR, Wis., has the largest coal dock, handling 200 tons hourly.

INDUSTRIAL SUMMARY.

New Enterprises :—

The Barnes Iron Bridge & Fence Co. has been incorporated at Camden, N. J.

The Hartmeyer Water Cooler & Filter Manufacturing Co., of Zanesville, O., has filed articles of incorporation; capital stock, $25,000.

It is reported that the Sequatchie Iron & Steel Co. has been incorporated, with a capital stock of $500,000, to build a rolling mill at South Pittsburg, Tenn.

J. Phillips, T. M. Pace and others, will build foundry and machine shops at Cedartown, Ga., and have incorporated the Cedartown Foundry & Machine Works.

The Mill & Mine Electric Equipment Co., of Pittsburgh, Pa., will apply for a charter for the manufacture and sale of electrical and mechanical appliances.

It is reported that the Pine Mountain (Ky.) Iron & Coal Co. has been reorganized, and will organize companies to build an iron furnace, manufacture brick, etc.

The Baxter Electric Motor & Manufacturing Co. has been incorporated by Jesse Hilles, B. S. DeFord, S. W. Regester and others, of Baltimore, Md.; capital stock, $500,000.

The New Castle Wire Nail Co., of New Castle, Pa., has been incorporated, with a capital stock of $300,000; directors, William Patterson, John Stevenson, Jr., and Robert W. Cunningham.

It is reported that the Loch Laird Land, Estate & Mineral Co. has completed the negotiations with the Beuna Vista Co., of Beuna Vista, Va., and will build a tin-plate mill, ferro-manganese and steel plants.

The East Tennessee Land Co., of New York, is organizing a stock company to build a $200,000 iron furnace at the new town of Harriman, Tenn. The furnace contemplated is to have a capacity of 125 tons of iron daily.

The Sinclair-Scott Manufacturing Co. has been incorporated at Baltimore, Md., to manufacture agricultural implements and machinery; capital stock, $60,000; incorporators, Wm. G. Atkinson, J. Baker, K. Harrison and others.

The Western Stove Manufacturing Co., of St. Louis, Mo., has been incorporated, with a capital stock of $83,000; directors, J. T. Dugdale, Lucas Edal, John H. Wallering, James M. Shuman, Wm. Gray, John Nyhaf, Henry Sanders, B. H. Griss and Frederick Schulter.

The American Axe & Edged-Tool Co. was formed in Pittsburgh last week, to operate the axe and edged-tool companies of the country, under the management of their former owners. The capital stock of the new concern will be $4,000,000, and will give employment to 10,000 men.

The Judson L. Thomson Manufacturing Co. has been organized at Portland, Me., with a capital stock of $700,000 paid in. President, Judson L. Thomson, Syracuse, N. Y.; Treasurer, Wilbur G. Davis, Concord, Mass. The company will manufacture buckles, rivets and different kinds of hardware specialties.

The Buena Vista Fence Co. will erect buildings at Buena Vista, Va., for the manufacture of plain and ornamental picket and other fences. The officers are: President, W. F. Pierson, Lexington; Vice-president, John McQuaide, Staunton; Treasurer, W. H. H. Lynn, Staunton; Manager, J. M. Henkel, Lexington.

The latest acquisition to Muncie's new industries is the organization of a stock company to be known as the Muncie Novelty & Brass Co., with a capital stock of $100,000, with C. F. Hathaway, president; A. S. Nichols, Michigan City, vice-president; Wm. A. Hearsey, Lyons, N. Y., secretary and treasurer, and U. S. Mallon, general business manager.

The M. Steel Co. is the new name of a corporation at Springfield, O., and is the outgrowth of Blakeney Foundry Co. The new company starts in with a paid-up capital stock of $72,000, and the products will consist of everything in the line of general foundry business. The officers are: President, Marshfield Steele; Vice-president, Frank J. Webb; Secretary, George M. Steele; General Manager, Elwyn D. Plaisted.

The American Fire-proof Steel Car Co. is the name of the new company which was reported last week as organized at Chicago. It has completed the arrangements for the plant, which will occupy 700 acres of land, lying between Ashland avenue, Halsted street, 147th and 159th streets. The village created by the erection of the steel works and the residences of its operatives will be known as Harvey. Five hundred men are to be employed as soon as the plant is ready for business.

Recent Illinois incorporations: Olney Vehicle Spring-Support Manufacturing Co., capital, $20,000; incorporators, T. A. Fritchey, Aden Knoph and J. T. Ratcliff.—St. Louis Steel Foundry Co., East St. Louis, to do a general manufacturing business; capital, $75,000; incorporators, Thomas Howard, Edward F. Goltra and John W. Harrison.—Norton Brothers, Chicago, to do a manufacturing business in metal goods; capital, $1,000,000; incorporators, O. W. Norton, Edwin Norton, O. F. Swift.—Combination Wood & Metal Tie Co., Chicago, to manufacture a patent railroad tie of wood and metal; capital stock, $1,000,000; incorporators, F. J. and J. G. Hoyt and M. Weston.—United States Enameled Shingle Co., East St. Louis; incorporators, Geo. Friesch, L. W. Straw, Fred A. Cornell, A. C. Delano and Conrad Bechtold.

Enlargements, Additions, Removals, Etc.:—

The South Baltimore (Md.) Car Works will, it is reported, build additional car shops.

The United States Rolling Stock Co., Anniston, Ala., will erect a $50,000 rolling mill

The Stella Grate Works, of Chattanooga, Tenn., will establish a factory at Florence, Ala.

The Farrel Foundry & Machine Co., Ansonia, Conn., has increased its capital from $100,000 to $110,000.

F. H. Bascom, of Montpelier, Vt., is negotiating with the Bryant Nail Co., who were recently burned out at Lynn, Mass., to induce them to locate in Montpelier. The company is capitalized at $250,000, and as Montpelier exempts all new manufactories from taxation for ten years, it is said that the company will locate there if $40,000 worth of stock will be taken by residents.—[Manufacturers' Gazette.

Shoenberger & Co., Pittsburgh, Pa., are at present perfecting a system of making horseshoes, which will add considerably to their facilities.

The Carpenter Steel Works, of Reading, Pa., are putting up extensive works at Boston, Mass., which will give employment to from 700 to 1,000 hands.

The Benwood Iron Co., of Wheeling, W. Va., will soon commence the erection of a new furnace of large capacity, which will include several decided improvements.

Fires and Accidents :—

Gardiner, Me.—The machine shop of Harvey Scribner has been destroyed by fire. Loss, $15,000.

Montreal, Can.—The iron foundry of Moses Parker was gutted by fire January 25. Loss, $30,000.

Lunsdall, Pa.—The stove works of Abraham Cox were destroyed by fire February 4. Loss, $80 000, with two-thirds insurance.

Cariboo, B. C.—The government reduction works were destroyed by fire February 4. Loss, $25,000. It is expected that the government will rebuild at once.

Oil City, Pa.—The machine shops of the Oil City Boiler Works were burned February 2. Loss, $40,000; covered by insurance. The works will rebuild at once on a larger scale.

Roebling's wire mills at Trenton, N. J., was the scene of two shocking accidents last week. A "hooker up" in the mill, in attempting to seize a piece of red hot iron it broke near the tongs and entered his right side just above the hip, and passing through the lung came out beneath the left arm pit. As the rod passed through the young man's body the end caught in a part of the machinery, and for an instant the boy was suspended in the air on the red hot iron. His weight broke the iron and he fell in front of the furnace on his feet, but soon expired. A fine wire drawer, of the same mill, was pierced in the stomach the day before, by the wire breaking and before the reel could be stopped about ten feet of it had curled up in the man's stomach.

General Industrial Notes:—

The pay-roll of the Cherry Valley Iron Works at Leetonia, O., for the two weeks ending on February 1st, amounted to upwards of $15,000, and was distributed among 752 employes.

The W. F. & John Barnes Co., of Rockford, Ill., manufacturers of drills and foot power machinery, have issued new catalogues, in both English and Spanish, and will be pleased to mail either edition upon application.

Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until 2 o'clock P. M., on the 4th day of March, 1890, for furnishing and putting in place, complete, one hydraulic passenger elevator, for the U. S. Postoffice, etc., building, at St. Joseph, Mo.

Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 7th day of March, 1890, for all the labor and materials required to complete the approaches to the U. S. Postoffice, etc., building at Springfield, O.

The time for receiving and opening the proposals for the labor and materials required for the stone and brick masonry of the superstructure or the United States Custom House, Postoffice, etc., building at Port Townsend, Wash., is hereby extended until 2 o'clock P. M., on the 13th day of March, 1890.

Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 28th day of February, 1890, for all the labor and materials required to fix in place, complete, the low temperature, hot water heating and ventilating apparatus for the U. S. Postoffice, etc., building at Springfield, Mass.

On February 4th the Ætna Machine Co., Warren, O., received an order from Messrs. Westerman & Co., Lockport, N. Y., for a 550 H. P. engine to drive a train of rolls in their mills at Lockport, and on February 10th received an order from Mr. Ralph J. Wick, treasurer of the Lancaster Iron Co., Lancaster, O., for a 550 H. P. engine to drive a train of rolls in the mills at Lancaster. This is the second engine sold to the Lancaster Co., and the third to Mr. Ralph J. Wick.

Best Furnace Record Ever Made.

We learn from Mr. James Gayley, superintendent of furnaces at the Edgar Thomson Steel Works, at Braddock, Pa., that furnace F., which went out of blast on August 7, 1889, was relined and blown in again on the 25th of September. Some slight changes were made in the furnace lines with a view to obtaining greater economy in fuel, but otherwise the furnace is practically the same as before. The results so far obtained have been a great improvement over the former run. Commencing with the month of November the record of output and fuel consumption has been as follows:

Bessemer iron—Gross tons.		Pounds of coke per gross ton of iron produced.
November	9,097	1,897
December	10,603	1,756
January	10,536	1,737
Best week's output	2,462	1,702
Best day's output	457	.....

The best record obtained during the previous blast was as follows:

Bessemer iron—Gross tons.		Pounds of coke per gross ton of iron produced.
Month	8,478	1,994
Week	2 161	.....
Day	419	.....

These records certainly warrant the erection of the three brooms, and the hoisting of the American flag, which the men have enthusiastically raised at the tunnel-head of the furnace.—[Bulletin.

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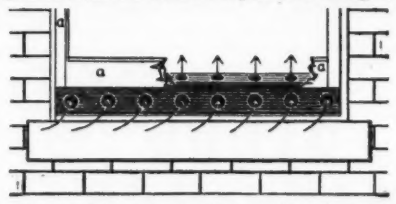

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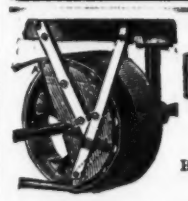

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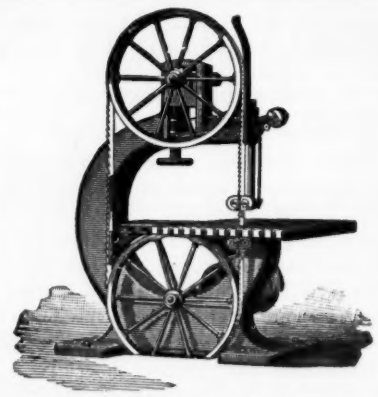

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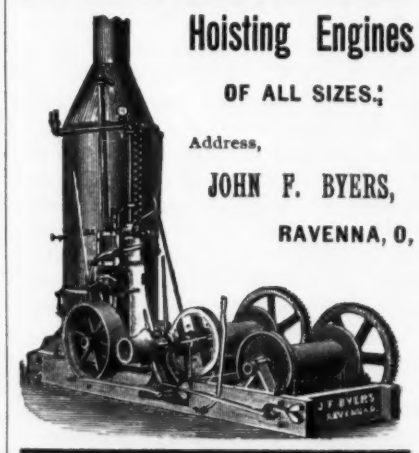

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STEEL TRUSSES FOR MASTS.

There is no problem of greater interest to ship-builders and owners along the Atlantic coast, just now, than that of devising a safe and otherwise satisfactory rig for the big four-masted schooners that have become so fashionable within the past three or four years. Instead of the long, thick, heavy spar rising from the midship line, it is proposed to substitute two neat, substantial steel trusses. The trusses are to be built of three or four pieces of flat steel set edgewise to the side of the ship, and united by angle irons riveted between them and by tie rods, which would make the truss at once light, stiff and symmetrical. Where the trusses meet at the cross-trees they would be riveted to a stiff steel cylinder, in which the topmast would be stepped. From the heel of this topmast, or from the steel cylinder in which it was stepped would be stretched a steel rope, the lower end of which would be set up in a stout eye-bolt set into a deck beam. The sail could be secured to this perpendicular stay by clips, just as the yacht jibs are secured to a jib-stay. The boom and gaff would swing on metal collars put around the rope. The sail would swing to and fro as readily as it now does. The steel rope on which it swung, if of proper size, would stand a much greater strain than any wooden mast. Further to strengthen the trusses that at once replace mast and shrouds, cross-plates and tie-rods could be run from truss to truss, but if the truss-plates were made of suitable size, and the size could be easily calculated, these long tie-rods would not be necessary.

Demand for Structural Iron.

An enumeration of the contemplated enterprises in which structural iron will be used, would be extremely interesting reading to manufacturers of structural iron, and all of those who would be called upon to furnish material and supplies. Elevated railroad work is projected upon a scale of great magnitude; no less than a score of cities are contemplating elevated work of one kind or another, and quite a number of second and third-class cities are interesting themselves in schemes looking to the establishment of facilities for rapid transit, or for belt lines. Railway companies in many cities have schemes well matured for the construction of terminal facilities, short cuts, etc., all of which will call for the product of structural mills. A scheme is on foot in Baltimore for the construction of a system of elevated railways which will call for the expenditure of about $30,000,000, according to current newspaper reports. The agents of iron and steel makers, who have been watching these budding enterprises, are of the opinion that a very large amount of work will undoubtedly be presented this season and next by the promoters. There is urgent demand for the prosecution of such work. Lack of sufficient funds, or the possible unwillingness of councilmanic bodies to tax their municipalities for such improvements, may interfere with some of these schemes; but the fact remains that the necessity for elevated railroads in our cities is yearly becoming more imperative.—[American Manufacturer.

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Those seeking new fields for manufacturing establishments should not fail to investigate **the wonderful development of Iron, Coal and Coke Industries that has been made within the past five years along the line of the Norfolk & Western Railroad, and the advantages offered by the State of Virginia in the supply of cheap raw materials, by the Norfolk & Western Railroad** in the matter of freight facilities and rates upon raw materials and for reaching home, far distant and foreign markets, and by the cities and towns along its line in the way of advantageous sites, at moderate cost. Many of the cities and towns exempt manufacturing establishments from taxation for a series of years.

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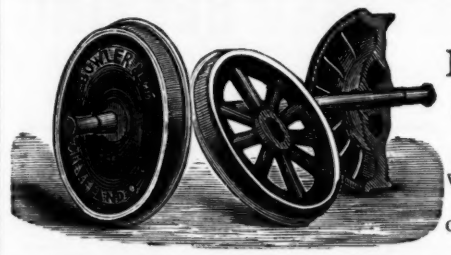

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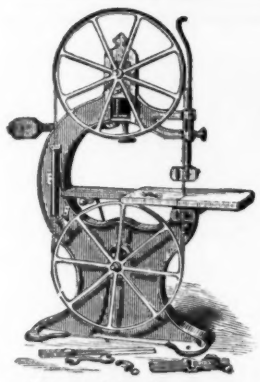

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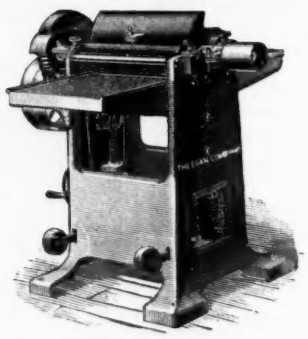

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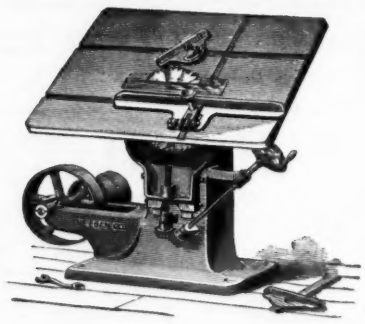

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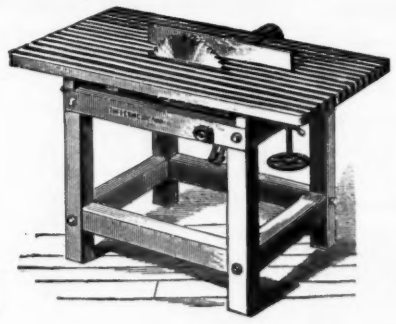

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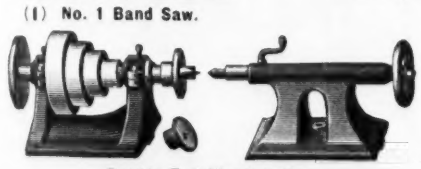

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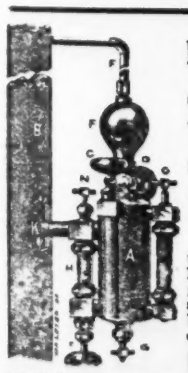

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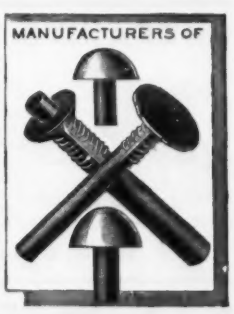

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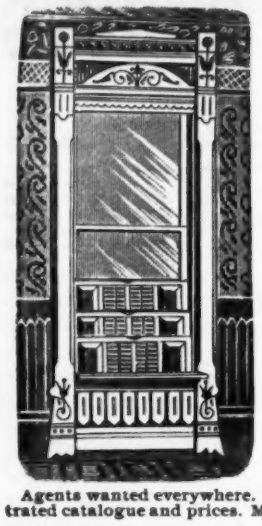

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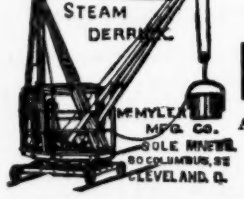

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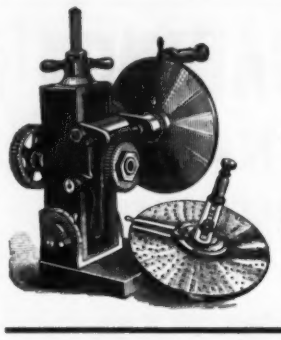

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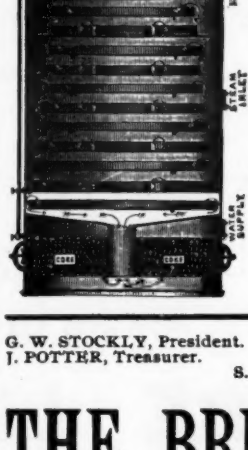

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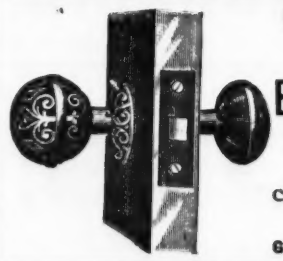

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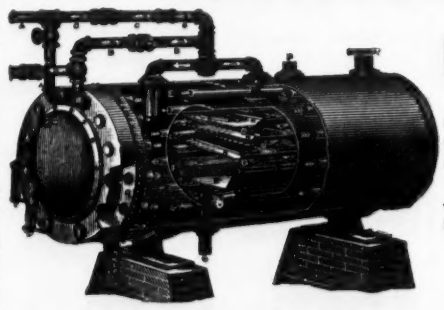

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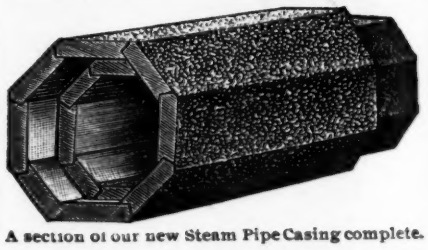

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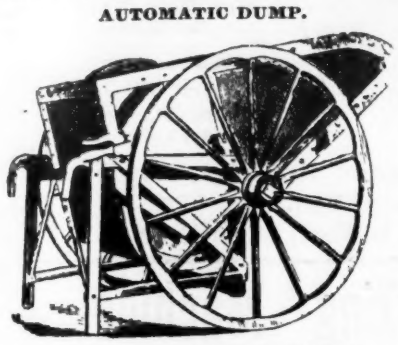

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1½ to 6 by 1¼ to 2 inch	2 40
1¼ & 1¾ by ⅜ to ¾ inch	2 10
1 & 1¼ by ⅜ to ¾ inch	2 20
⅝, ¾ and ⅞ by ⅜ to ⅝ inch	2 40

Round and Square.

1 to 1⅜ inch	2 00
2 to 2⅝ inch	2 20
2¾ to 3¼ inch	2 50
3⅜ to 4 inch	3 00
4¼ to 4½ inch	3 50
4¾ to 5 inch	3 70

Oval.

⅜ to 1¼ inch	2 40
⅜ to ¾ inch	2 60
½	2 80
⅝	3 20

Half Oval and Half Round.

1½ to 3 inch	3 10
⅜ to 1¼ inch	2 70
⅜ to ¾ inch	3 20
½	3 50
⅝	5 00

Heavy Band.

1½ to 6 by ¼ and 5-16 inch	2 20
" to 1¾ by ¼ and 5-16 inch	2 30
¼ to ⅜ by ¼ and 5-16 inch	2 50
½ to ¾ by ¼ and 5-16 inch	3 00

Hoops.

1¼ to 4, Nos. 13 to 15	2 80
1¼ to 2, Nos. 16 to 18	2 90
1¼ to 2, No. 19	3 05
1¼ to 2, No. 20	3 10
1¼ to 2, No. 21	3 20
1¼ to 2, No. 22	3 30
15-16, 1 and 1¼, Nos. 13 to 15	3 00
15-16, 1 and 1¼, Nos. 16 to 18	3 10
15-16, 1 and 1¼, Nos. 19 and 20	3 20
15-16, 1 and 1¼, No. 21	3 30
15-16, 1 and 1¼, No. 22	3 40
⅞, Nos. 13 to 15	3 20
⅞, Nos. 16 to 18	3 30
⅞, Nos. 19 and 20	3 40
⅞, No. 21	3 50
⅞, No. 22	3 60
13-16, Nos. 13 to 15	3 40
13-16, Nos. 16 to 18	3 50
13-16, Nos. 19 and 20	3 60
13-16, No. 21	3 70
13-16, No. 22	3 80
¾, Nos. 13 to 15	3 50
¾, Nos. 16 to 18	3 70
¾, Nos. 19 and 20	3 80
¾, No. 21	3 90
¾, No. 22	4 00
11-16, Nos. 13 to 15	3 70
11-16, Nos. 16 to 18	3 90
11-16, Nos. 19 and 20	4 00
11-16, No. 21	4 10
11-16, No. 22	4 20
⅝, Nos. 13 to 15	4 00
⅝, Nos 16 to 18	4 20
⅝, Nos. 19 and 20	4 30
⅝, No. 21	4 40
⅝, No. 22	4 50
⅝, No. 23	4 60

Light Band.

1¼ to 6 by ⅛ to 3-16 in	2 50
1¼ to 6 by Nos. 11 and 12	2 60
1 to 1¾ by ⅛ to 3-16 in	2 60
1 to 1¾ by Nos. 11 and 12	2 70
⅞ and 13-16 by ⅛ to 3-16 in	2 90
⅞ and 13-16 by Nos. 11 and 12	3 00
¾ and 11-16 by ⅛ to 3-16 in	3 20
¾ and 11-16 by Nos. 11 and 12	3 30
⅝ and 9-16 by ⅛ to 3-16 in	3 50
⅝ and 9-16 by Nos. 11 and 12	3 60
½ by ⅛ to 3-16 in	3 80
½ by Nos. 11 and 12	3 90

Wagon Box Iron.

⅛ inch, beveled edge, by Nos. 11 and 12	3 00
⅛ inch, " " " 13 and 14	3 20
¼ inch, " " " 11 and 12	3 30
¼ inch, " " " 13 and 14	3 50

Sheet Iron.

No. 10 to 14	2 75
No. 15 to 17	2 90
No. 18 to 21	3 10
No. 22 to 24	3 30
No. 25 to 26	3 45
No. 27	3 55
No. 28	3 65

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 80
C No. 1, " "	3 05
C H No. 1 " "	3 30
C H Flange, "	4 05
Extra Flange, "	4 55
Solid Fire Box "	5 30

Steel Boiler Plates—1-4 in. and Heavier.

Tank	3 00
Shell	3 40
Flange	3 70
Marine Flange	4 10
Fire Box	4 80

Above includes plates 90 inches wide.

90 to 96 in. wide	⅛c ₶ extra
96 to 100 in. wide	1 c "
100 to 104 in. wide	1⅛c "
104 to 116 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. ₶s
1 to 2 in. inclusive	09
9-16 to ⅞ in "	09
7-16 to ⅝ and 2⅜ to 3 in	10½
3⅛ to 4 in	11
⅝ to 11-16 and 4⅛	10½
⅛ to 6 in	11½
¼ to 9-32 and 6⅛ to 7 in	12
3-6 in	14

Flats.

	cts. ₶s
2 to 9-16 wide by 2 to ⅛ thick	9

Bessemer and O. H. Steel.

Machinery	base price,	3 00
Tire	"	3 00
Spring	"	3 50
Sleigh Shoe	"	3 00
Toe Calk	"	3 25
Cutter Shoes, tapered and burr.	"	3 25

English Tool Steel.

Jessop's	16c
Hobson's "Best"	16c
" "Choice"	36c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	4 00
Bridge ½, ⅝, 11-16 and ¾ inch diam	4 00

SCRAP IRON AND OLD METAL.

NET TONS	
No. 1 R. R. wrought scrap	$22 00
No. 1 wrought scrap	20 00
No. 1 Machine cast scrap	14 00
Iron axles	20 00
Axle turnings	16 00
Wrought turning (free from cast)	14 00
Cast borings	10 00
Uncut wrought iron boilers	13 00
Steel boiler plates	15 00
Grate Bars	8 50
Pipes and flues (Clean)	14 00
Tank iron	14 00
Hoop and band iron	14 00
Sheet iron	10 00
Wrought drillings	12 00
Malleable iron	10 00
GROSS TONS	
Old iron T rails	26 00
Old steel rails	25 00
Old car wheels	18 50
Old copper	₶ 10
No. 1 H. red Brass	11
Heavy yellow brass	8¼
Light yellow brass	6
Scrap Zinc	
Tea Lead	
Heavy Lead	3¼

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MACHINERY SUPPLY MARKET.

Anvils.

American.....₩ lb 9@10
Wrights.....₩ lb 9½

Bellows.

Blacksmiths' { Hill's.....dis 40 / Bullock's.....dis 50&10
Moulders'.....dis 40@40&10
Hand.....dis 40&10@50

Belting.

Boston Belting Co's standard.....dis 70@70& 5
" " " extra.....dis 60&5@60&10
" " " best.....dis 55
Hoyt's Short Lap.....dis 45
Cleveland Rubber Co. extra standard dis 60&10
Shultz Raw Hide Leather Belting, single, ...dis 35&5
Shultz Raw Hide Leather Belting, double, and Light Double.....dis 35&5
Standard, oak tanned.....dis 55@60
Alexander Brothers' pure oak tanned. ...dis 45

Blowers and Exhausters.

B. F. Sturtevant's.....dis 20
Boston Blower Co.,.....dis 35
Buffalo.....dis 35

Borax.

.....₩ lb 9½@10½

Chalk.

White.....₩ gross 50
White Crayon.....₩ gross 12@12½ dis 10
Red.....dis 70
Blue.....dis 85

Chucks.

Cushman's 4 Jaw Independent.....dis 45
" Combination.....dis 40
" Geared Scroll.....dis 30
" 2 Jaw Brass Workers.....dis 30
" Drill.....dis 35
Wescott's Scroll Combination.....dis 30
" Independent.....dis 45
" Little Grant Drill.....dis 30
Horton's Universal.....dis 40
" Independent.....dis 45
National Combination.....dis 40
Sweetland " .....dis 40
Skinner " .....dis 40
" Independent.....dis 40
Almond Drill.....dis 25
Morse " .....dis 15
Skinner " .....dis 30

Cutters and Reamers.

Cleveland.....dis 10@15
Pratt & Whitney.....dis 10@15
Standard.....dis 10@15
Brown & Sharpe, Milling Cutters.....dis 15
" " Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 4
Iron, steel points.....₩ lb 3½

Drill and Drill Stocks.

Twist drills.....dis 50&10
Morse Taper and Straight shank to 1¼".....dis 50&10
Morse Taper and Straight shank Larger than 1¼".....dis 25
Drill Sockets.....dis 25
Standard.....dis 50&10
Cleveland.....dis 50&10

Emery.

	No. 4 to 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ₩ lb	4 c	5 c		2½c
½ kegs ₩ lb	4½c	5½c		2¾c
¼ kegs ₩ lb	4½c	5½c		3 c
10 lb cans, 10 in case	6 c	6½c		5 c
10 lb cans, less than 10	10 c	10 c		7½c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 40@46
H. H. Barton.....dis 40@46

Emery Wheels.

Detroit.....dis 55@60
Norton's.....dis 55@60
Grant.....dis 55@60
Union Stone.....dis 60
Sterling.....dis 60
Vulcanite.....dis 15@20
Celluloid.....dis 10&33⅓
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60
Vulcanite.....dis 10&10

Files.

Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
Arcade.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.

Jack Screws.

Illinois Bolt Co. list.....dis 70

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¼	4	3¾	3½
Hexagon	15½	11½	8½	6	5¼	5¼	5
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ₩ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire.)

List July 14, 1887.....dis 70 &10
Standard Penny Nails, ₩ keg card rate
{ Car lots.....$2.30 / Less than car lots $2.40

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 10@11
Russia Packing " .....₩ lb 14
Italian Packing " .....₩ lb 13@14
Plumbago Piston.....₩ lb 40
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 6
Sheet Rubber.....₩ lb 12@24
Excelsior Rubber.....₩ lb 48

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 45
Medart Pulleys.....dis 55
Split Wood Pulleys.....dis 55

Rivets.

Iron, Thousand, list November 17, ...dis 50
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50
Copper.....dis 50@50&10

Rope.

Manilla, ½ inch and over.....₩ lb 15¼
Sisal, ½ inch and over.....₩ lb 13¾

Sand Paper.

B. A. & Co.....dis 40@40&10
H. H. Barton's.....dis 40@40&10
New England Flint.....dis 40@40&10
Barton's Garnet.....dis 30

Saws.

Disston's Circular.....dis 45
" Band.....dis 30
" Scroll.....Net
Hack Saw Stubs.....dis 30
" " Eureka.....dis 30
" " Star.....dis 30
Saw Swages Disston's.....dis 30
Atkins' Cicular Saws.....dis 50
" Mill, Mulay and Drag Saws..dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....dis 70c per ft
" Dexter Cross-cuts.....dis 50c "
" Diamond " .....dis 30c "
" Tuttle Tooth Cross-cuts..dis 25c "
" One-man Cross-cuts.....dis 32c "
No. 1 Handles.....dis 23c per pair
No. 6 " .....dis 16c "
Excelsior Saw Tools.....$6 per doz
Perfection " .....$15 "
Detroit Saw Works, Circular.....dis 50
" " " Band.....dis 25
" " " Mulay.....dis 45

Screws.

Wood Screws—List Jan 27, 1889.

Flat head iron.....dis 50
Round head iron.....dis 40
Flat head brass.....dis 45
Round head brass.....dis 35
Square Cap.....dis 65
Hexagon Cap.....dis 60
Set C. H. C. P.....dis 70
Machine, flat head, iron.....dis 55
Machine, round head, iron.....dis 50
Bench and hand—
Lag or coach.....dis 75@75&10
Coach, patent gimlet point.....dis 75

Shovels and Spades.

Ames' list November 1, 1885.....dis 20
Dennis.....dis 5.25
Hussey & Binns, railroad.....dis 8.00

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 50
Pulley Taps.....dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ½ lb Balls		21c@29c
No. 18 " " ¼ and ½ "		18c@28c
No. 36 " " ¼ and ½ "		16c@27c
2-Ply Hemp, ¼ & ½ lb Balls (Spring Twine)		11½c
3-Ply " 1 lb Balls		12@12½c
3-Ply " 1½ lb Balls		11@11½c
Cotton Wrapping, 5 Balls to lb		15@16c

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 10@15
Howard.....dis 30
Maneer's machinist.....dis 50&10

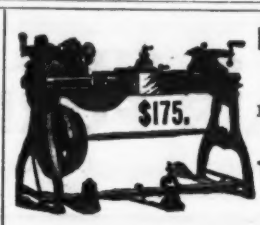
Wire.

New List, Jan. 18, 1884

Brass and copper.....dis 20@25
Bright and annealed, Nos. 0@18...dis 70&10@75
" " Nos. 19@26..dis 75@75& 5
" " Nos. 27@36..dis 75&10& 5
Coppered Nos. 0 to 18, market list..dis 70@70& 5
Galvanized Nos. 0 to 18 " .....dis 65&5
Tinned market Nos. 0 to 18.....dis 67½
Cast steel.....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9.....dis 75
Annealed Grape, Nos. 10 to 14.....dis 75
Stub's Steel Wire regular.....$6.00@lb dis 30

Wrenches.

Coe's genuine, cash in ten days.....dis 50
Girard Standard.....dis 70&10
Agricultural.....dis 75&10
Mechanics'.....dis 55&10,& 3
Bemis & Call's Combination.....dis 35
Donohue's Engineers.....dis 20&10
Lamson & Sessions Engineers.....dis 60
Billings & Spencer's Drop Forged.....dis 10
William's " " .....dis 10
Alligator " " .....dis 40



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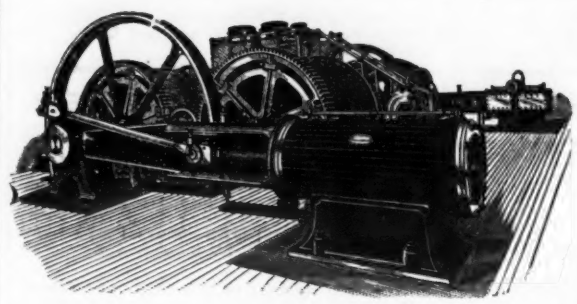

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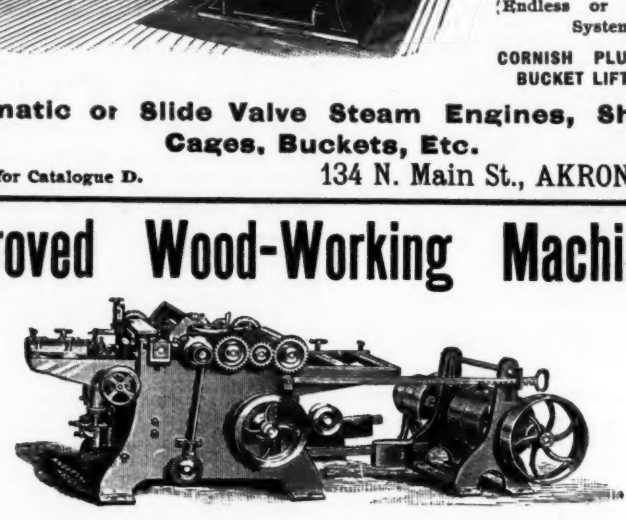

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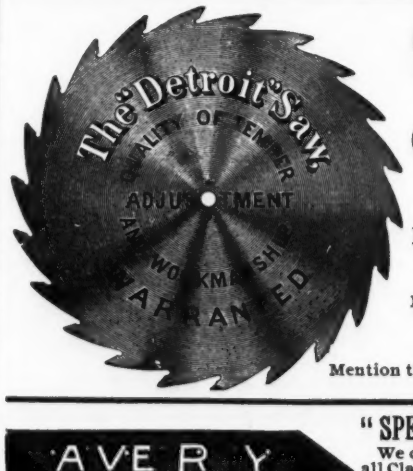

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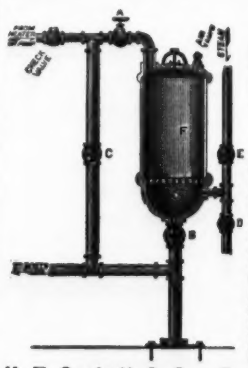

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HARDWARE MARKET.

Augers and Bits.

ommon augers and bits.....dis 70
nell's.....dis 60&5
Cook's Douglass Mfg. Co.....dis 55
Russell Jennings' augers and bits.....dis 25
Expansive Bits, Clark's small, $18; large, $26.....dis 35@35&5
Hollow Augers, Ives'.....dis 25&10
Hollow Augers, Bonney's Adjust. ₩ doz., $48.....dis 40&10
Hollow Augers, Stearns' Adjust. ₩ doz., $48.....dis 20&10
Gimlet bits, common.....per gross $2 75@3 25
Standard Bit Stock Drills.....dis 50&10&5
Ship Augers.....dis 15&10@15&10&5

Axes.

Makers' and Special Brands—
First quality.....₩doz. $6 25@6 75
Others.....₩doz. $5 75@6 00
Full polished.....$8 25

Bolts.

Cast iron barrel bolts.....dis 70
Cast iron shutter bolts, etc.....dis 70
Cast iron chain bolts.....dis 65&10
Ives' patent door bolt.....dis 60
Wrought iron barrel bolts.....dis 70
Wrought iron square bolts.....dis 70
Wrought shutter bolts.....dis 60&10
Sargent's list
Carriage, common, new list.....dis 70&12½
Tire, common, new list.....dis 70
Carriage and tire, Philadelphia pattern.....dis 75&10
Stove bolts.....dis 62½
Plow bolts.....dis 60&5
Machine.....dis 75&10@80
Ends.....dis 75&10&80

Buckets, Elevator.

.....dis 50&10

Butts.

Wrought brass.....dis 75&10
Cast brass, loose joint.....dis 33⅓
Cast Iron—
Fast joint, narrow.....dis 50&10&5@60&5
Fast joint, broad.....dis 55&10&5@60&10
Loose joint.....dis 70
Loose joint, jap.....dis 70
Loose joint, jap. with acorns.....dis 70
Loose pin, acorns.....dis 70
Loose pin, japanned acorns.....dis 70
Loose pin, acorns, jap. plated tips.....dis 70
Wrought steel—
Wrought, fast joint, narrow.....dis 70
Wrought, fast joint, broad.....dis 70
Wrought, loose joint, broad.....dis 70
Table Butts, back flaps, etc.....dis 70
Regular inside blind.....dis 70
Light inside blind.....dis 70
Loose pin.....dis 70
Light loose pin.....dis 70

Chains.

Trace, 6½-10-2.....₩ pair 1.03
Trace, 6½-10-3.....₩ pair .92 } 50&10@50&10&5
Trace, 7-10-2.....₩ pair 1.11
German Halter Chain, list June, 1887...dis 50&10
German Coil, list of June, 1887..dis 50&10&5@60
Galvanized Pump Chain.....₩ 05¼@6
Jack Chain, Iron.....dis 75@75&5
Jack Chain, Brass.....dis 70@70&5

Chisels.

Socket Framing and Firmer.....dis 75
Socket Framing and Firmer, Buck Bros..dis 30
Socket Firmer and Framing, L. & I. J. White.....dis 30@30&5
Tanged Firmers.....dis 40&10

Cutlery.

Table.....net
Excelsior Pocket.....net

Gimlets.

Nail and Spike.....dis 50&10&5
Double cut, low list.....dis 25
"Bee".....₩ gross $12, dis 25@25&5

Hangers.

Barn door, old patterns.....dis 10&10@70
Climax, (Anti-Friction).....dis 70
Star.....dis 40&10@40&10&5
Scranton.....dis 40
Kidder's.....dis 50&10@60
Terry's Patent.....5 in., $12; 4 in., $10, dis 50&5
Paragon.....dis 40&10
Richard's.....dis 30@30&10

Horse Nails.

	No.	10	9	8	7	6	
Ausable, ₩ lb.		23	24	25	26	28	dis 25&10@25&10&10
Putnam, ₩ lb.		18	19	20	21	23	dis 15
Essex							dis 25&10@25&10&10

Horse Shoes.

Burden, at factory.....₩ keg $4 00
R. I. Horshoe Co., Perkins' Imp. at factory.....₩ keg $4 00
Mule Shoes, at factory.....₩ keg $5 00

Knobs.

Carriage, japanned.....₩ gross 80c dis 60&10
Base, rubber tip.....dis 70&10&5
Hemacite door knobs, new list.....dis 40&10@50
Door mineral.....dis 65c@68c
Door Por. japanned.....dis 75c@78c
Door Por. nickle.....$2 00@2 25
Door Por. plated.....$2 00@2 25

Locks, Bolts, Etc.

P. & F. Corbear, Locks and Bronze Goods.
Door locks, knobs and latches.....dis 60
Escutcheons and keys.....dis 60
Padlocks and padlock keys.....dis 66⅔
Bell pulls, mineral, porcelain and jet.....dis 60
Bell pulls, genuine bronze.....dis 60&10
Lever bell pulls, genuine bronze.....dis 60&10
Butts', genuine bronze.....dis 60&10
Butts' bronze plated.....dis 60&10
Store door locks and latches.....dis 60&10
Store door handles.....dis 60&10
Shutter hinges&flaps, genuine bronze.dis 60&10
Shutter hinges, bronze plated.....dis 70
Flush bolts, genuine bronze.....dis 70
Shutter knobs, genuine bronze.....dis 50
Shutter bars, genuine bronze.....dis 60
Sash lifts, genuine bronze.....dis 60
Sash pulls and plates, genuine bronze.....dis 60
Push plates, genuine bronze.....dis 60
Drawer pull, genuine bronze.....dis 66⅔
Letter box plates, genuine bronze...dis 60&10
Barn door locks.....dis 33⅓
Bishop's Buckeye Sash Locks.....₩ gross $4.80

Plumbs and Levels.

Standard list.....dis 70&10@70&10&10
Pocket levels.....dis 70&10@70&10&10
Davis' inclinometers.....dis 10&10

Pumps.

Cistern, best makers.....dis 50&10@00
Pitcher spout, best makers dis 60&10@60&10&10
Pitcher spout, cheaper goods dis 70&5@70&10&5

Pokes, Animal.

Bishop's I. X. L.....₩ doz $6 00
Bishop's O K.....₩ doz $5 25
Bishop's Pioneer.....₩ doz $3 75
Bishop's American.....₩ doz $2 75

Rakes.

Cast steel.....dis 65&5
Malleable.....dis 70@70&5

Razors.

J. R. Torrey Razor Co.....dis 20
Wostenholme & Butcher.....$10@[illegible]...dis 10
Rifle razor.....dis $9 50 net

Scales.

Hatch, Counter, No. 171.....₩ doz $21 00
Hatch, Tea, No. 161.....₩ doz $6 75@7 00
Chatillon's Grocers.....dis 50
Family Turnbulls.....dis 30@30&10
Scale Beams, List of January 12, 1882.....dis 50&10@50&10&4

Screw Drivers.

Stanley R. & L. Co.'s Varnished Handles.....dis 65&10
Stanley R. & L. Co.'s Black Handles..dis 60&10
Sets interchangeables.....₩ doz $18 dis 25

Squares.

Steel and iron, Nickel plated.....dis 75&10@80
Disston's try square and T bevels.....dis 45&10
Winterbottom's try and miter.....dis 30&10

Tacks, Brads, Etc.

New List, January 2, 1888.

American iron carpet tacks all kinds.....dis 70&5
Steel carpet tacks all kinds.....dis 70&5
Swedes iron carpet tacks, all kinds.....dis 70&5
Swedes iron tacks.....dis 70&5
Swedes iron Upholsterers' tacks.....dis 70&5
Tinned Swedes iron tacks.....dis 70&5
Tinned Swedes iron Upholsterers' tacks.....dis 70&10
American iron cut tacks.....dis 6⅓&5
Copper tacks.....dis 50
Copper finishing and trunk nails.....dis 50&00
Cigar box nails.....dis 45&10
Finishing nails.....dis 65
Hungarian nails and miners' tacks.dis 62½&5
Gimp and lace tacks.....dis 70&5
" " " tinned.....dis 60&10
Trunk and clout nails.....dis 66⅔
Tinned trunk&clout nails.....dis 66&10
Basket nails.....dis 66&10
Chair nails.....dis 66&10
Common and patent brads.....dis 66&10
Tinned capped trunk nails.....dis 60

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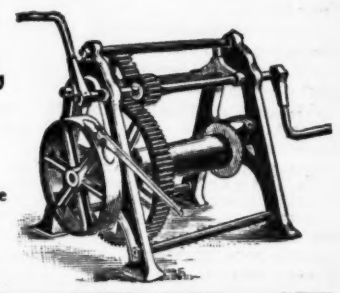

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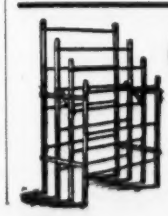

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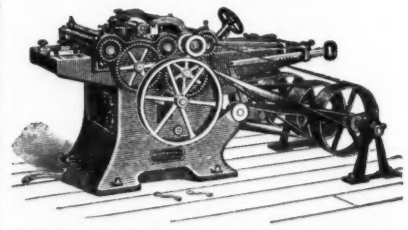

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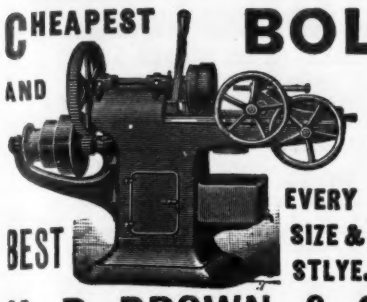

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Akron, Col. & Cin. "Flyer"	5 40 p m	8 10 a m
Akron, Col. & Cin. Night Express	7 00 a m	8 00 p m
Akron, Col. & Zanesv'e Ex.	12 50 p m	1 05 p m
Akron & Orrville Accom.	9 40 a m	3 25 p m

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	Arrive.	Depart.
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Fast N. Y. & Pitts. Express	*10 55 a m	*3 00 p m
Mahoning Accommo.		†6 40 a m
Pittsburgh Express.	†6 25 p m	
Youngstown Local.	†8 05 a m	
Mahon'g div. & Pitts Local		*11 40 a m
Mahoning Val. Accom.		†4 30 p m
Pittsburgh Express.	†1 20 p m	11 10 p m
New York Express.	*8 00 p m	.....

*Daily. †Daily, except Sunday. ‡Daily except Monday.

Cleveland & Canton Railroad.

(Standard Gauge.)

Depart for—

Zanesville and Coshocton—6:50 a. m., 3:00 p. m.
Canton—6:50 a. m., 3:00 p. m., 6:20 p. m.
Kent—6:50 a. m., 3:00 p. m., *5:45 p. m. 6:20 p. m.
Bedford—6:50 a. m., 11:10 a. m., 1:30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m. 10:35 p. m.
Newburgh—6:15 a. m., 6:50 a. m., 11:10 a. m., 1.30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m., 10:35 p. m.

Arrive from—

Zanesville and Coshocton—10:30 a. m., 6:30 p. m.
Canton, 10:30 a. m., 2:35 p. m., 6:30 p. m.
Kent—*8:10 a. m., 10:30 a. m., 2:35 p. m., 6:30 p.m.
Bedford—6:00 a. m., *8:10 a.m., 10:30 a.m., 1:05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p.m., 7:10 p.m.
Newburgh—6:00 a. m., 7:15 a. m., *8:10 a. m., 10:30 a. m., 1.05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p. m., 7:10 p. m.

Trains marked * run daily.

Valley Railway.

FOR AKRON, CANTON AND MARIETTA.

Depot foot South Water Street.

	Depart.	Arrive.
Valley Junction Mail.	*7 45 a m	*6 25 p m
Marietta Express.	†11 15 a m	†2 25 p m
Valley Junction Express.	*4 15 p m	*10 25 a m
Cleve. and Canton Express	*7 05 p m	†8 20 a m

*Daily. †Daily, except Sunday.

WM. THORNBURGH, Gen. Manager. R. A. CARRAN, Gen. Pass. Agt.

Cleveland, Lorain and Wheeling.

All trains arrive and leave the Union Depot as follows:

	Depart.	Arrive.
Wheeling Express.	6 45 a m	6 55 p m
Uhrichsville Express.	4 00 p m	9 20 a m

OSCAR TOWNSEND Gen. Mang'r.

From Cleveland Union Station.

PENNSYLVANIA LINES.

Cleveland & Pittsburgh R. R.

	Depart.	Arrive.
For Pittsburgh, Baltimore, Washington, Philadelphia and New York.	8 00 a m	d5 25 a m
	1 05 p m	12 50 p m
	d11 10 p m	6 35 p m
Wheeling and Bellaire.	8 00 a m	12 50 p m
	1 05 p m	6 35 p m
	*11 10 p m	.....
Alliance Accom.	3 25 p m	9 40 a m
Ravenna Accom.	5 00 p m	8 25 a m

d Daily. * Except Saturday. Other trains except Sunday.

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Cleveland & Marietta Ry.

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"THE BECKMAN"

204 SUPERIOR ST.

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The P. & L. E. sits enthroned as queen."

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	Depart.
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No. 72, New York Express.	* 8 10 a m
No. 72, Fast Pittsburgh Express.	* 8 10 a m
No. 64, Fast Pittsburgh Express.	* 3 00 p m
No. 66, Mantua Accommo.	* 4 20 p m
No. 68, New York Vestibule Limited.	* 8 30 p m
No. 70, Pittsburgh Local Express.	*11 25 a m
No. 74, Pittsburgh & Youngst'n Ex.	†11 00 p m
	Arrive.
No. 65, Fast New York Express.	*10 15 a m
No. 61, N. Y. & Pittsburgh Express.	* 7 15 a m
No. 71, Leavittsburg Local.	† 2 10 p m
No. 67, Pittsburgh Express.	*12 45 p m
No. 63, New York Express.	* 6 50 p m
No. 63, Pittsburgh Express.	* 6 50 p m
No. 69, Pittsburgh Local Express.	† 9 10 p m
No. 73, Mantua Accommo.	* 7 20 p m
No. 75, Pittsburgh & Youngst'n Ex.	† 2 55 a m

*Daily. †Daily, except Sunday.

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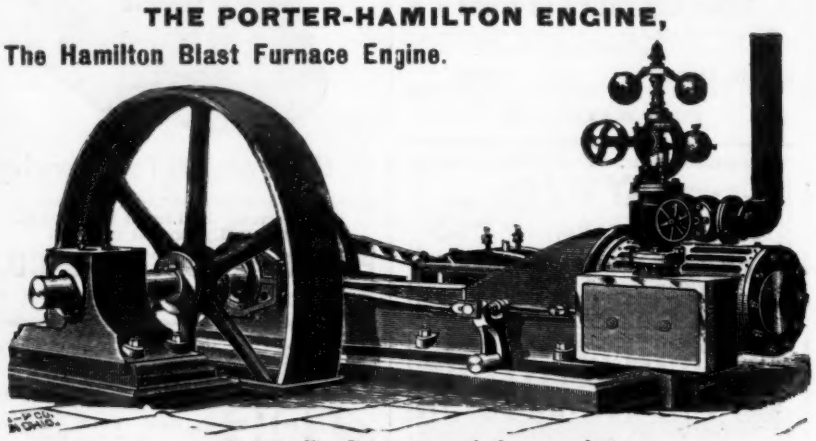

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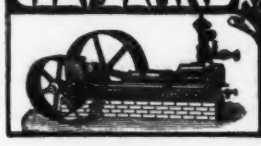
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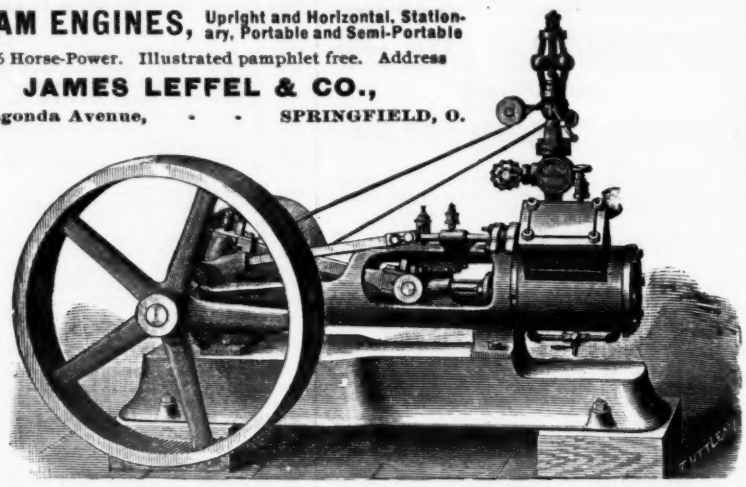

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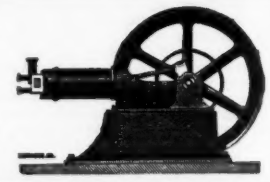

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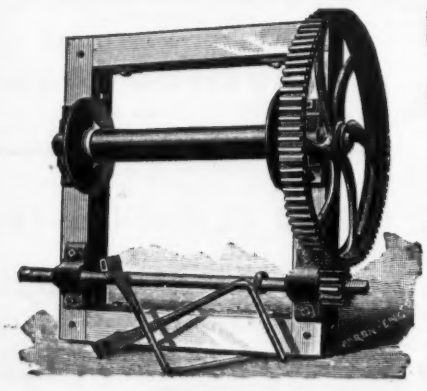

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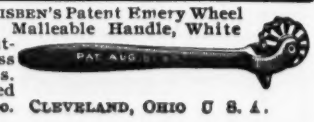

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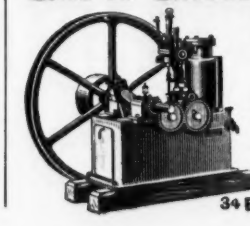
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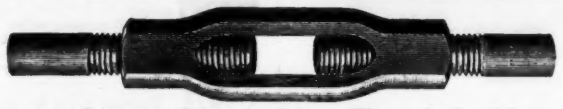

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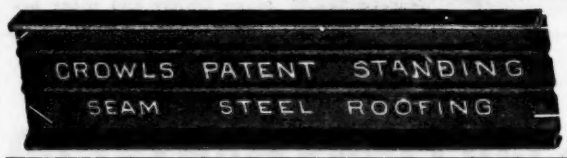

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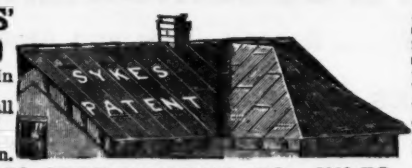

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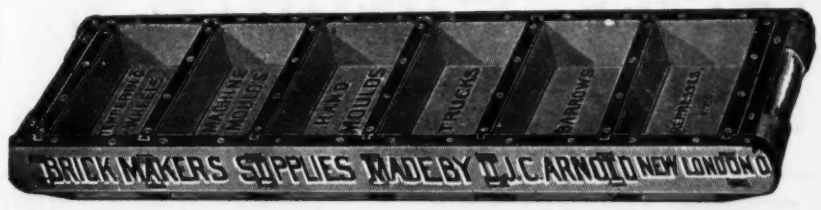

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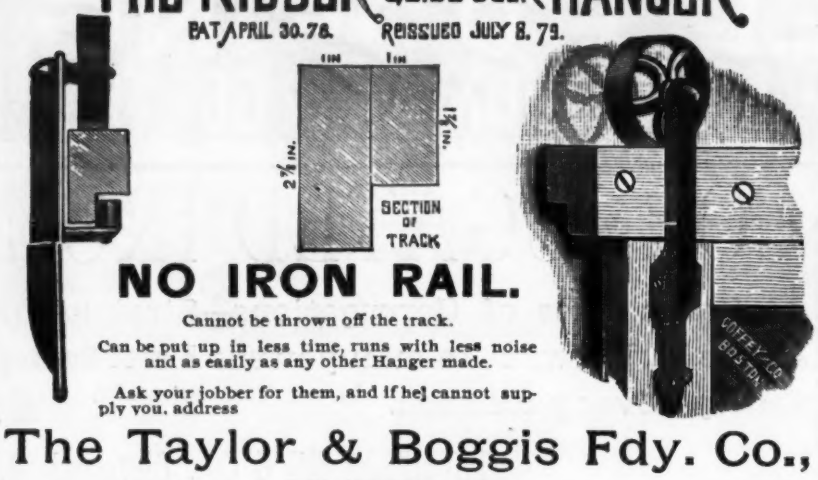

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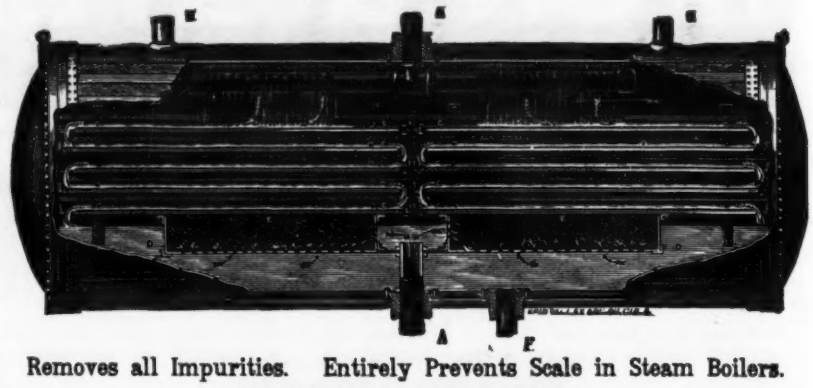

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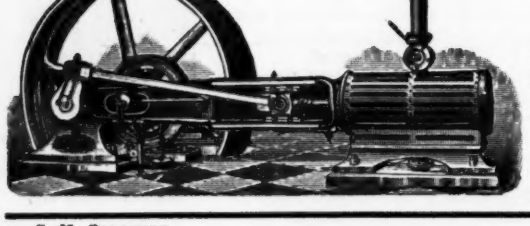

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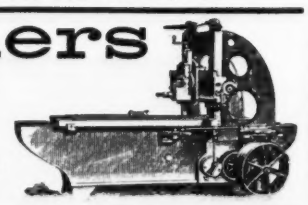

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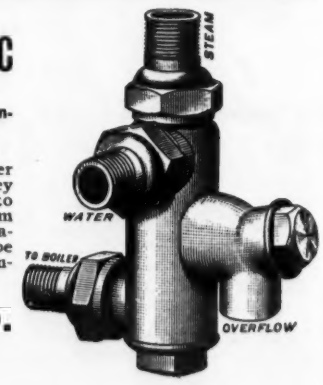

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